(19) JAPANESE PATENT OFFICE

PATENT ABSTRACTS OF JAPAN

(11) Publication number: **2000163791 A**

(43) Date of publication of application: **16.06.00**

(51) Int. Cl **G11B 7/135**
G11B 7/125

(21) Application number: **10337190**

(22) Date of filing: **27.11.98**

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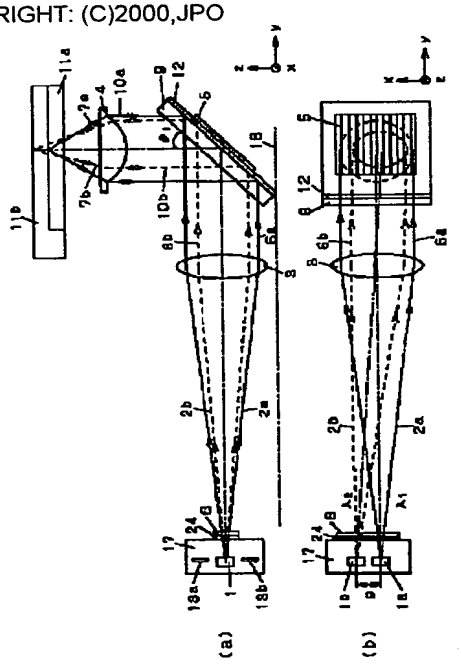
(54) **OPTICAL HEAD**

(57) Abstract:

PROBLEM TO BE SOLVED: To provide a small and lightweight optical head which is compatible with plural kinds of information recording media and has light sources of two wavelengths arranged in the neighborhood of each other.

SOLUTION: This optical head is constructed so that a 1st light source 1a emitting light of a 1st wavelength and a 2nd light source 1b emitting light of a 2nd wavelength are arranged in the neighborhood of each other, the light 6a of the 1st wavelength collimated through a collimator lens 3 is reflected by a wavelength separating means 12 provided on the back of a transparent substrate arranged substantially at an angle of 45° to a reference plane 18, light 6b of the 2nd wavelength is transmitted through the wavelength separating means 12 and diffracted by a reflective linear grating 5 provided on the underside thereof, and is made incident on an object lens 4 by making the optical axis of the light of the 2nd wavelength to the optical axis of the light of the above-mentioned 1st wavelength.



(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号
特開2000－163791
（P2000－163791A）
(43)公開日　平成12年６月16日(2000.6.16)

(51)Int.Cl.'	識別記号	FI		テーマコード'（参考）
G11B 7/135		G11B 7/135	Z	5D119
7/125		7/125	A	

審査請求　未請求　請求項の数22　ＯＬ　（全 11 頁）

(21)出願番号　特願平10－337190

(22)出願日　平成10年11月27日(1998.11.27)

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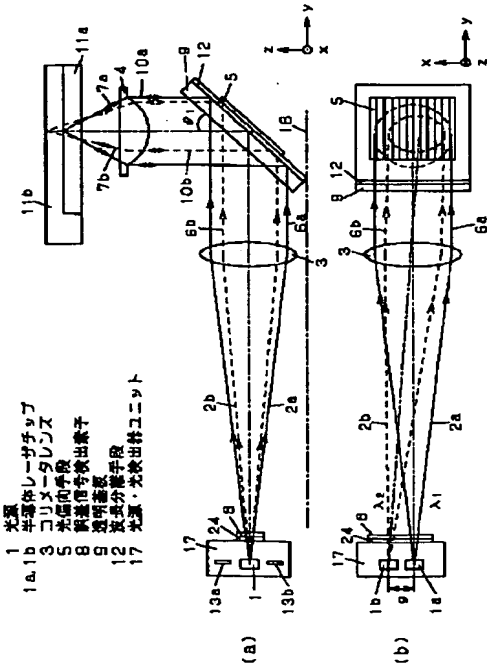
(54)【発明の名称】　光学ヘッド

(57)【要約】
【課題】　複数の種類の情報記録媒体に対応でき、互いに近傍に配置した２波長の光源を有する小型軽量の光学ヘッドを提供する。
【解決手段】　第１の波長の光を出射する第１の光源１ａと、第２の波長の光を出射する第２の光源１ｂをその近傍に配置し、コリメータレンズ３により平行光となった第１波長の光６ａは、基準面１８に対して実質上45°で配置した透明基板９の裏面に設けた波長分離手段１２で反射し、第２波長の光６ｂは波長分離手段１２を透過してその下面に設けた反射形の直線グレーティング５で回折し、上記第１の波長の光１０ａの光軸に、第２の波長の光１０ｂの光軸を平行にして、対物レンズ４に入射する構成である。



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【特許請求の範囲】

【請求項１】第１の波長の光を出射する第１の光源と、上記第１の光源の近傍に配置された、第２の波長の光を出射する第２の光源と、上記第１と第２の波長の光を分離する波長分離手段と、分離された上記第２の波長の光を、分離された上記第１の波長の光と光軸が実質上平行になるように偏向を行う光偏向手段を具備したことを特徴とする光学ヘッド。

【請求項２】波長分離手段は第１の波長の光を実質上反射させ、第２の波長の光を実質上透過することを特徴とする請求項１に記載の光学ヘッド。

【請求項３】波長分離手段は波長分離多層膜である請求項２に記載の光学ヘッド。

【請求項４】透明基板上に波長分離手段を設け、上記透明基板のその対向面に光偏向手段を設け、第１及び第２の波長の光は、波長分離手段側から入射することを特徴とする請求項２に記載の光学ヘッド。

【請求項５】透明基板上に波長分離手段を設け、その上に光偏向手段を設け、第１及び第２の波長の光は、上記透明基板のその対向面側から入射することを特徴とする請求項２に記載の光学ヘッド。

【請求項６】透明基板は基準面に対して、実質上４５°に配置することを特徴とする請求項４または５に記載の光学ヘッド。

【請求項７】光偏向手段は回折光学素子であることを特徴とする請求項１に記載の光学ヘッド。

【請求項８】回折光学素子は反射形の直線状グレーティングであることを特徴とする請求項７に記載の光学ヘッド。

【請求項９】第１の光源と第２の光源は、基準面に対して、実質上同一高さに配置することを特徴とする請求項１に記載の光学ヘッド。

【請求項１０】光偏向手段は反射形の直線状グレーティングであって、基準面に対して上記グレーティングの溝方向に傾けて配置することを特徴とする請求項９に記載の光学ヘッド。

【請求項１１】グレーティングは断面形状が鋸歯形状であり、基準面の法線からの、溝方向に傾けた傾斜角を$\theta 1$とし、その屈折率をｎとしたとき、第２の波長$\lambda 2$に対して、上記グレーティングの溝深さＬが、$L=\lambda 2/(2n\cos\theta 1)$の関係を実質上満たすことを特徴とする請求項１０に記載の光学ヘッド。

【請求項１２】グレーティングは断面形状がレベル数ｐのマルチレベル形状であり、基準面の法線からの、溝方向に傾けた傾斜角を$\theta 1$とし、その屈折率をｎとしたとき、第２の波長$\lambda 2$に対して、上記グレーティングの溝深さＬが、$L=(p-1)\lambda 2/(2pn\cos\theta 1)$の関係を実質上満たすことを特徴とする請求項１０に記載の光学ヘッド。

【請求項１３】第１の光源と第２の光源は、実質上基準面に対して高さ方向に配置することを特徴とする請求項１に記載の光学ヘッド。

【請求項１４】光偏向手段は反射形の直線状グレーティングであって、基準面に対して、上記グレーティングの溝に垂直な方向に傾けて配置することを特徴とする請求項１３に記載の光学ヘッド。

【請求項１５】グレーティングに対する第２の波長の光の入射角$\theta 2$は、$-50° \leqq \theta 2 \leqq 50°$の関係を実質上満たすことを特徴とする請求項１４に記載の光学ヘッド。

【請求項１６】第１の波長は、第２の波長より小さいことを特徴とする請求項１に記載の光学ヘッド。

【請求項１７】波長分離手段と光偏向手段の間にバッファ層を設けることを特徴とする請求項５記載の光学ヘッド。

【請求項１８】光偏向手段は表面レリーフ型の回折光学素子であり、その溝の底部から波長分離手段までの距離は、第１の波長よりも大きいことを特徴とする請求項５記載の光学ヘッド。

【請求項１９】情報記録媒体側を第１面、光源側を第２面、基準面側を第３面とする３つの光学面を有するプリズムの第３面に波長分離手段を設け、その下面に光偏向手段を設け、第１及び第２の波長の光は、上記第２面から入射し、上記第１面、第３面、第１面の順に通過することを特徴とする請求項２に記載の光学ヘッド。

【請求項２０】少なくとも第１の波長の光の光路中に、プリズムの色分散を低減する色収差補正グレーティングを設けることを特徴とする請求項１９に記載の光学ヘッド。

【請求項２１】グレーティングは、第１の光源と第２の光源の距離が大きいほど、その周期を小さくすることを特徴とする請求項８に記載の光学ヘッド。

【請求項２２】第１の波長の第２の波長に対する大きさの比Ｒは０．７５≦Ｒ≦０．９を実質上満たし、第１または第２の光源と波長分離手段の光路中に、３ビームグレーティングを設け、その断面は実質上矩形または台形形状であり、第１の波長$\lambda 1$をし、屈折率をｎとしたとき、その溝深さは、実質上$\lambda 1/(n-1)$であることを特徴とする請求項１に記載の光学ヘッド。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、光学的記録再生装置の光学ヘッドに関し、特に、複数の種類の情報記録媒体に対応でき、互いに近傍に配置した２波長の光源を具備する小型・薄型・軽量の光学ヘッドに関する。

【０００２】

【従来の技術】コンパクトディスク（ＣＤ）、ＤＶＤ等の光ディスクや光カードメモリ等の情報記録媒体の信号を読み出すための重要な構成部品として光学ヘッドがある。光学ヘッドは、光学的記録媒体から信号を取り出す

ために、信号検出機能だけでなくフォーカスサーボ、トラッキングサーボ等の制御機構を備える必要がある。

【０００３】ＤＶＤやＣＤまたはＣＤ-Ｒの複数の情報記録媒体に対応するために、光源を２つ搭載した光学ヘッドがあった。従来の２波長の光源を有する光学ヘッドを図８に示す。

【０００４】ＤＶＤに対応した第１の波長λ1を出射する第１の光源１’ａと、ＣＤやＣＤ－Ｒに対応した第２の波長λ2を出射する第２の光源１’ｂは、それぞれ別々の光源・光検出器ユニット１７’ａ、１７’ｂに内蔵されており、それらから出射されたレーザ光２’ａ、２’ｂはビームスプリッタ１４により合波され、コリメータレンズ３’で平行になり、立ち上げミラー１５で光軸を９０°折り曲げられ、対物レンズ４’により、光ディスク１１（ＤＶＤは１１ａ、ＣＤは１１ｂ）に集光される。

【０００５】光ディスク１１で反射された信号光は、逆向きに折り返し、ビームスプリッタ１４により分波され、光源・光検出器ユニット１７’ａ、１７’ｂの窓に設けられたフォーカス／トラック誤差信号検出器８’ａ、８’ｂにより、光検出器１３’上に集光され、再生信号が読み出される。また、フォーカス／トラックサーボ等の制御が行われ、安定して信号が読み出せるようにしている。

【０００６】

【発明が解決しようとする課題】しかしながら、ＤＶＤやＣＤまたはＣＤ-Ｒ等の複数の情報記録媒体に対応するために、光源を別々のパッケージ（光源・光検出器ユニット）に内蔵し、ビームスプリッタ等で合成するような従来の構成では、光学ヘッドの小型・薄型・軽量化に限界があり、しかも位置合わせが複雑で、さらなる簡素化、組立の簡単化ができないという課題があった。

【０００７】本発明は、従来技術における前記課題を解決するためになされたものであり、特に、複数の種類の情報記録媒体に対応でき、互いに近傍に配置した２波長の光源を具備する小型・薄型・軽量の光学ヘッドを提供することを目的とする。

【０００８】

【課題を解決するための手段】前記目的を達成するため、本発明の請求項１に記載の発明は、第１の波長の光を出射する第１の光源と、上記第１の光源の近傍に配置された、第２の波長の光を出射する第２の光源と、上記第１と第２の波長の光を分離する波長分離手段と、分離された上記第２の波長の光を、分離された上記第１の波長の光と光軸が実質上平行になるように偏向を行う光偏向手段を具備したことを特徴とする光学ヘッドである。これにより、例えば、互いに近傍に配置された２波長の光源を用いた、小型軽量で、複数の種類の情報記録媒体に対応できる光学ヘッドを得ることができる。

【０００９】また、本発明の請求項２に記載の発明は、波長分離手段は第１の波長の光を実質上反射させ、第２の波長の光を実質上透過させる請求項１に記載の光学ヘッドである。これにより、例えば、コンパクトな構成を実現することができる。

【００１０】また、本発明の請求項３に記載の発明は、波長分離手段は波長分離多層膜である請求項２に記載の光学ヘッドである。

【００１１】これにより、例えば、薄型で他の光学部品に集積化することができ、構造が安定になる。

【００１２】また、本発明の請求項４に記載の発明は、透明基板上に波長分離手段を設け、上記透明基板のその対向面に光偏向手段を設け、第１及び第２の波長の光は、波長分離手段側から入射する請求項２に記載の光学ヘッドである。これにより、例えば、光学部品の位置合わせが簡単になり、構造が安定化することができる。

【００１３】また、本発明の請求項５に記載の発明は、透明基板上に波長分離手段を設け、その上に光偏向手段を設け、第１及び第２の波長の光は、上記透明基板のその対向面側から入射する請求項２に記載の光学ヘッドである。これにより、例えば、光学部品の位置合わせが簡単になり、構造が安定化するとともに、実質上平行になる第１と第２の波長の光の最大強度の中心位置を近づけ、光ディスク上で良好な集光スポットを形成することができる。

【００１４】また、本発明の請求項６に記載の発明は、透明基板は基準面に対して、実質上４５°に配置する請求項４または５に記載の光学ヘッド。これにより、例えば、透明基板と一体化した光学部品は立ち上げミラーを兼ねることができる。

【００１５】また、本発明の請求項７に記載の発明は、光偏向手段は回折光学素子である請求項１に記載の光学ヘッドである。これにより、例えば、光偏向手段は薄型軽量化を行うことができる。

【００１６】また、本発明の請求項８に記載の発明は、回折光学素子は反射形の直線状グレーティングである請求項７に記載の光学ヘッドである。これにより、例えば、光偏向手段の製造が簡単で、位置合わせが容易な光学ヘッドを得ることができる。

【００１７】また、本発明の請求項９に記載の発明は、第１の光源と第２の光源は、基準面に対して、実質上同一高さに配置する請求項１に記載の光学ヘッドである。これにより、例えば、第１と第２の光源の配置が容易になる。

【００１８】また、本発明の請求項１０に記載の発明は、光偏向手段は反射形の直線状グレーティングであって、基準面に対して上記グレーティングの溝方向に傾けて配置する請求項９に記載の光学ヘッドである。これにより、例えば、グレーティングの１次回折効率を高くできる構成が可能である。

【００１９】また、本発明の請求項１１に記載の発明

は、グレーティングは断面形状が鋸歯形状であり、基準面の法線からの、溝方向に傾けた傾斜角を$\theta 1$とし、その屈折率をｎとしたとき、第２の波長$\lambda 2$に対して、上記グレーティングの溝深さＬが、$L=\lambda 2/(2n\cos\theta 1)$の関係を実質上満たすことを特徴とする請求項１０に記載の光学ヘッドである。これにより、例えば、グレーティングの１次回折効率を最も高くできる。

【００２０】また、本発明の請求項１２に記載の発明は、グレーティングは断面形状がレベル数ｐのマルチレベル形状であり、基準面の法線からの、溝方向に傾けた傾斜角を$\theta 1$とし、その屈折率をｎとしたとき、第２の波長$\lambda 2$に対して、上記グレーティングの溝深さＬが、$L=(p-1)\lambda 2/(2pn\cos\theta 1)$の関係を実質上満たすことを特徴とする請求項１０に記載の光学ヘッドである。これにより、例えば、グレーティングの製造が容易で、１次回折効率を最も高くすることができる。

【００２１】また、本発明の請求項１３記載の発明は、第１の光源と第２の光源は、実質上基準面に対して高さ方向に配置する請求項１に記載の光学ヘッドである。これにより、第１の光源と第２の光源の配置を容易にすることができる。

【００２２】また、本発明の請求項１４に記載の発明は、光偏向手段は反射形の直線状グレーティングであって、基準面に対して、上記グレーティングの溝に垂直な方向に傾けて配置する請求項１３に記載の光学ヘッドである。これにより、例えば、対物レンズに入射する第１の波長の光と第２の波長の光の光軸の、側面図における奥行き方向のずれを実質上無くすことができる。

【００２３】また、本発明の請求項１５に記載の発明は、グレーティングに対する第２の波長の光の入射角$\theta 2$は、$-50^\circ \leqq \theta 2 \leqq 50^\circ$の関係を実質上満たすことを特徴とする請求項１４に記載の光学ヘッドである。これにより、例えば、グレーティングの１次回折効率を高くし、例えば、９０％以上にすることができる。

【００２４】また、本発明の請求項１６に記載の発明は、第１の波長は、第２の波長より小さいことを特徴とする請求項１に記載の光学ヘッドある。これにより、例えば、一般的に光源の出射効率が悪いという波長が小さい方の第１の波長の光利用効率を、第２の波長の光利用効率より大きくすることができる。

【００２５】また、本発明の請求項１７に記載の発明は、波長分離手段と光偏向手段の間にバッファ層を設ける請求項５記載の光学ヘッドである。これにより、例えば、波長分離手段からしみ出す、光偏向手段への第１の波長の光の影響を無くし、第１の波長の光の光利用効率を良くすることができる。

【００２６】また、本発明の請求項１８記載の発明は、光偏向手段は表面レリーフ型の回折光学素子であり、その溝の底部から波長分離手段までの距離は、第１の波長よりも大きい請求項５記載の光学ヘッドである。これにより、例えば、波長分離手段からしみ出す、光偏向手段への第１の波長の光の影響を無くし、第１の波長の光の光利用効率を良くすることができる。

【００２７】また、本発明の請求項１９に記載の発明は、情報記録媒体側を第１面、光源側を第２面、基準面側を第３面とする３つの光学面を有するプリズムの第３面に波長分離手段を設け、その下面に光偏向手段を設け、第１及び第２の波長の光は、上記第２面から入射し、上記第１面、第３面、第１面の順に通過する請求項２に記載の光学ヘッドである。これにより、例えば、光路をプリズム内のジグザグ伝搬をとる構成により光学ヘッドを薄型にすることができる。

【００２８】また、本発明の請求項２０に記載の発明は、少なくとも第１の波長の光の光路中に、プリズムの色分散を低減する色収差補正グレーティングを設ける請求項１９に記載の光学ヘッドである。これにより、例えば、光源からの出射光として半導体レーザ光を用いた場合、高周波モジュールや自励発振による数nm程度の波長帯域の広がりや環境温度の変化によって出射光の中心波長が変化しても、プリズムの色分散を低減して光ディスク面で良好な集光スポットを得ることができる。

【００２９】また、本発明の請求項２１記載の発明は、グレーティングは、第１の光源と第２の光源の距離が大きいほど、その周期を小さくする請求項８に記載の光学ヘッドである。これにより、例えば、第１の光源と第２の光源の任意の距離に対して２波長の光源の光軸を実質上平行にすることが可能である。

【００３０】また、本発明の請求項２２に記載の発明は、第１の波長の第２の波長に対する大きさの比Ｒは０．７５≦Ｒ≦０．９を実質上満たし、第１または第２の光源と波長分離手段の光路中に、３ビームグレーティングを設け、その断面は実質上矩形または台形形状であり、第１の波長$\lambda 1$をし、屈折率をｎとしたとき、その溝深さは、実質上$\lambda 1/(n-1)$である請求項１に記載の光学ヘッドである。これにより、例えば、第１の波長の光に対する光利用効率は落とさずに、第２の波長の光に対して、３ビームトラッキング法により、トラッキング制御を行うことが可能である。

【００３１】

【発明の実施の形態】（第１の実施の形態）本発明の第１の実施の形態の光学ヘッドについて、図１から図３までを用い、座標軸を図のようにとって詳細に説明する。

【００３２】図１（ａ）は本発明の第１の実施の形態における光学ヘッドの基本構成と光の伝搬の様子を示す側面図、図１（ｂ）は本発明の第１の実施の形態における光学ヘッドの基本構成と光の伝搬の様子を示す裏面図、図２（ａ）は同実施の形態の光学ヘッドにおける波長分離手段、光偏向手段の説明図、図２（ｂ）は同実施の形態のさらに他の光学ヘッドにおける波長分離手段、光偏向手段の説明図、図３（ａ）は本発明の第１の実施の形

態の光学ヘッドにおける第１の波長に対する３ビームグレーティングの回折効率と溝深さの関係図、図３（ｂ）は本発明の第１の実施の形態の光学ヘッドにおける第２の波長に対する３ビームグレーティングの回折効率と溝深さの関係図である。

【００３３】本実施の形態の光学ヘッドは、互いに近傍に配置された２波長の光源を搭載し、例えば、ＤＶＤやＣＤ、ＣＤ－Ｒ等の複数の情報記録媒体に対応できる、小型・薄型・軽量の光学ヘッドを実現する。

【００３４】図１に示すように、光源・光検出器ユニット１７内に、２波長の光源１と光検出器１３が内蔵されており、光源として、例えば、第１の波長λ1=0.658μmの光２ａを出射する半導体レーザチップ１ａと、例えば、第２の波長λ2=0.8μmの光２ｂを出射する半導体レーザチップ１ｂが、それらの中心位置の距離ｇが、例えば、４００μm程度離れた近傍に配置されている。

【００３５】光源１ａと１ｂは、通常同時に発光するものではなく、光ディスク１１の種類に応じて選択的に光を出射するものである。本実施の形態では、基準面１８（ｘｙ平面に平行な光学ヘッドの下面）に対して、２波長の光源１は実質上同一高さになるように配置してある。このような配置にすることにより、配置が容易となる。２波長の光源１となる半導体レーザチップを互いに近傍に配置することにより、従来例のようなビームスプリッタ等の光学部品が省略できるため、光学ヘッドが簡素化・小型・薄型・軽量化でき、また組立の際の位置合わせが容易になる。

【００３６】光源１から選択的に出射されたレーザ光２ａまたは２ｂは、光源・光検出器ユニット１７の窓側に設けた、３ビームグレーティング２４を透過し、それと一体化した、例えば、ホログラム素子であるフォーカス／トラック誤差信号検出素子８を透過（０次回折光利用）して、例えば、焦点距離２０ｍｍのコリメータレンズ３により、ビーム径が例えば、第１の波長の光は３ｍｍ程度、第２の波長の光は２．２ｍｍ程度の略平行光６ａ、６ｂとなる。このとき、光源１ａとコリメータレンズ３の中心を結ぶ第１の波長の光２ａ、６ａの光軸は、ｙ軸に平行となるように配置し、光源１ｂとコリメータレンズ３の中心を結ぶ２ｂ、６ｂの光軸は、基準面１８に平行でｙ軸方向に対して、例えば、１．１５°傾いている（図１（ｂ）参照）。

【００３７】３ビームグレーティング２４は、第２の波長の光２ｂに対してのみ回折して３ビーム（０次、±１次回折光）になり、トラッキング検出できるように設けたもので、第１の波長の光２ａに対しては、透明基板のようにただ通過するだけである。特に、ＣＤ－Ｒの光ディスクを第２の波長の光で読み出す際のトラッキング検出法は、３ビーム法が好ましく、ＤＶＤの光ディスクを第１の波長の光で読み出す際のトラッキング検出法は、位相差法が好ましいためにそのような構成にすると、それらの光ディスクに対して、有効にトラッキング検出ができる。

【００３８】本発明者らは、３ビームグレーティング２４の断面を実質上矩形または台形形状である２レベルグレーティングとすると、図３に示すように、例えば、第１の波長λ1=0.658μm、屈折率ｎ＝1.5に対して、その溝深さは、実質上λ1／（ｎ－１）＝1.32μmのとき、第１の波長の光に関しては、ほとんどすべて透過する（0次回折光～１００％）が、このとき、例えば、波長λ2=0.8μmの第２の波長の光に対しては、０次回折光と1次回折光の比が最適なほぼ７：１程度になることを見い出した。さらに、本発明者らは、第１の波長の第２の波長に対する大きさの比Ｒは０．７５≦Ｒ≦０．９を実質上満たし（上記の記述では、Ｒ＝０．８２）、その溝深さは、実質上λ1／（ｎ－１）であれば、第１の波長の光利用効率をほとんど落とさずに、第２の波長に対してのみ、有効に３ビームトラッキング制御ができることを見い出した。

【００３９】第１の波長の光６ａは、基準面１８に対して実質上４５°で配置された、例えば、厚さ１ｍｍ程度のガラス等である透明基板９の、無反射コート（図示なし）が設けられた表面を透過し、その裏面に形成された、例えば、波長分離多層膜である波長分離手段１２により実質上反射され、光軸を実質上９０°折り曲げて、ｚ軸方向の平行光１０ａとなり、対物レンズ４に入射し、収束光７ａとなって光ディスクであるＤＶＤ１１ａ上に集光される。

【００４０】第２の波長の光６ｂも、透明基板９内を透過するが、さらに波長分離手段１２も実質上通過し、その上に形成された（図１(a)では下面）、例えば、反射形の直線状ブレーズ化グレーティング（例えば、周期が４０μm）である反射形の光偏向手段５に入射し、偏向、反射されて（偏向はｘ軸方向成分のみ）、光軸が実質上ｚ軸に平行になり、同じく対物レンズ４に入射し、ＣＤ１１ｂに集光される。第１の波長の光１０ａの光軸と第２の波長の光１０ｂの光軸が平行になった結果、対物レンズ４に入射する光軸が垂直になり、どちらの波長に対しても、コマ収差や非点収差が生じることなく良好に対物レンズ４で集光することが可能である。また、透明基板９と一体化された波長分離手段１２と光偏向手段５は、１つの集積部品となり、構造が安定で位置合わせが容易となり、しかも立ち上げミラーを兼ねることができる。

【００４１】波長分離手段１２と光偏向手段５を組み合わせて設けたことにより、光偏向手段５であるグレーティングの周期は大きくでき、製造が容易である。

【００４２】光ディスク１１によって反射されたレーザ光７は、逆方向に折り返し、対物レンズ４、透明基板９を通過し、第２の波長の光１０ｂのみ光偏向手段５によりｘ軸成分のみ偏向されて、コリメータレンズ３を通過

して、フォーカス／トラック誤差信号検出素子８によって分割されて（１次あるいは２次回折光利用）、光検出器１３で検出される。

【００４３】波長分離手段１２は、本実施の形態においては、例えば、ＳｉＯ2とＴｉＯ2の誘電体薄膜を透明基板９上に交互に堆積した構造の波長分離多層膜を用いたが、このような多層膜構成では波長分離手段を数μm以内の薄さにでき、透明基板と集積一体化可能で、構造が安定になるという効果があった。また、波長分離手段１２は非常に薄くできるため、対物レンズ４に入射する第１の波長の光１０aと第２の波長の光１０ｂの最大強度位置は、ほぼ中央部に設定することができる（なお、図１(a)では、波長分離手段１２を誇張して厚く描いているため、ずれているようになっている）。

【００４４】また、光偏向手段５は、回折光学素子である、反射形の直線状グレーティングを用いた。回折光学素子の光偏向手段を用いることにより、光学ヘッドを薄型化、軽量化、低価格化を図ることができる。

【００４５】本実施の形態においては、基準面１８に対して、グレーティング５をその溝方向に傾けて配置した。このように配置することによって、実効的に垂直入射した場合と同じ高い１次回折効率が得られるという効果がある（例えば、後述する図６のグラフでθ2＝0の相当する高い１次回折効率、例えば、９５％が得られる）。

【００４６】図２に示すように、グレーティング５または５’は、表面レリーフ型で、表面に反射層１６が形成され、それぞれ、断面形状が鋸歯形状（図２(a)）、マルチレベル形状（図２（ｂ）は４レベル形状）であり、基準面１８の法線（ｚ軸）からの、溝方向に傾けた傾斜角をθ1とし、その屈折率をｎとしたとき、第２の波長λ2に対して、上記グレーティングの溝深さＬが、Ｌ＝λ2／（２ｎcosθ1）（鋸歯形状の場合）、Ｌ＝（ｐ－１）λ2／（２ｐｎcosθ1）（マルチレベル形状で、ｐはレベル数）の関係を実質上満たすようにした。このような傾斜角に依存した溝深さにすることにより、１次回折効率を最大（例えば、９５％から９８％）にすることができた。反射層１６としては、ＡｇやＡｕ、Ａｌ等の金属層、または誘電体の多層膜を用いることが可能である。

【００４７】また、グレーティング５または５’の溝の底面から波長分離手段までの距離ｓは、第１の波長λ1よりも大きくした。第１の波長の光６ａが波長分離手段１２で反射する際、ごくわずかにそこからしみ出す現象がおこるが、このような構成により、グレーティング５または５’の溝部へのしみ出しを無くし、第１の波長の光６ａは全く回折しなくなり、光利用効率を良くすることができる。また、波長分離手段１２と光偏向手段５の間に、例えば、第１の波長よりも厚いＳｉＯ2層等のバッファ層を設けても同じ効果が得られる。

【００４８】グレーティング５の周期Λは、例えば、４０μmであり、このときの波長λ2に対する１次回折角は、λ2=0.8μmの場合、θd＝１．１５°となり、ちょうど第２の波長の光の光軸ずれの角度を補正することができる。なお、回折角θdは、第２の波長の光の光軸ずれの角度（コリメータレンズ３の焦点距離ｆと光源の中心距離ｇにより、ｔａｎ-1（ｇ／ｆ）で表される）と同じにすることにより、両波長に対する光軸を平行にすることが可能であり、回折角は、θd=sｉｎ-1（λ2/Λ）で表されるので、この式を実質上満足するように、グレーティング５の周期Λを設定すれば良い。本実施の形態の光偏向手段５であるグレーティングは、波長分離手段９の形成された透明基板１２上に、例えば、公知の２Ｐ法により、紫外線硬化樹脂を用いて金型から転写して作製した。

【００４９】また、本実施の形態では、波長が大きい方の光を第２の波長の光とし、光偏向手段５により偏向させたが、一般に、波長が大きい光を出射する半導体レーザ光源のほうが出射効率が良いため、光のパワに余裕があり、光偏向手段５で多少損失があっても問題なく使用できるためである。なお、波長が小さい方の光を第２の波長の光としてももちろん動作は可能である。

【００５０】（第２の実施の形態）本発明の第２の実施の形態の光学ヘッドについて、図４を用いて、上記第１の実施の形態と異なる点を中心に説明する。

【００５１】図４（ａ）は本発明第２の実施の形態における光学ヘッドの基本構成と光の伝搬の様子を示す側面図、図４（ｂ）は本発明の第２の実施の形態における光学ヘッドの基本構成と光の伝搬の様子を示す裏面図である。

【００５２】図４に示すように、本実施の形態の光学ヘッドにおいては、透明基板９の表面に波長分離手段１２を設け、その対向面に光偏向手段５を設け、第１及び第２の波長の光６は、波長分離手段１２側から入射する構成である。本実施の形態でも透明基板９と一体化された波長分離手段１２と光偏向手段５は、１つの集積部品となり、構造が安定で位置合わせが容易となり、しかも立ち上げミラーを兼ねることができる。

【００５３】第１の波長の光６ａは、基準面１８に対して実質上４５°で配置された、例えば、厚さ１ｍｍ程度のガラス等である透明基板９の表面に設けた例えば、波長分離多層膜である波長分離手段１２で実質上反射され、光軸を実質上９０°折り曲げて、ｚ軸方向の平行光１０ａとなり、対物レンズ４に入射し、収束光７ａとなって光ディスクであるＤＶＤ１１ａ上に集光される。

【００５４】第２の波長の光６ｂは、波長分離手段１２も実質上透過し、透明基板９内を通って、その対向面に形成された、例えば、反射形の直線状ブレーズ化グレーティング（例えば、周期が４０μm）である反射形の光偏向手段５に入射し、ｘ軸方向成分のみ偏向、反射され

て、光軸が実質上ｚ軸に平行になり、同じく対物レンズ４に入射し、ＣＤ１１ｂに集光される。

【００５５】本実施の形態の光学ヘッドでは、第１の波長の光６ａが、透明基板９を通ることなく、波長分離手段１２表面で反射されるので、光利用効率が多少向上する。しかしながら、第１の実施形態の光学ヘッドに比べて、透明基板９の厚さがあるため、対物レンズ４に入射する第１の波長の光１０ａと第２の波長の光１０ｂの最大強度の中心位置のずれ量が大きくなるという課題が発生する。

【００５６】（第３の実施の形態）本発明の第３の実施の形態の光学ヘッドについて、図５と図６を用いて、上記第１の実施の形態と異なる点を中心に説明する。

【００５７】図５は本発明の第３の実施の形態における光学ヘッドの基本構成と光の伝搬の様子を示す側面図、図６は本発明の第３の実施の形態の光学ヘッドにおけるグレーティング（光偏向手段）への入射角θ２と１次回折効率の関係図である。

【００５８】図５に示すように、本実施の形態においては、第１の光源１ａと第２の光源１ｂは、実質上基準面１８に対して高さ方向（ｚ軸方向）に、例えば、４００μｍ離れて配置している。これにより、第１と第２の光源の配置が容易になる。

【００５９】また、例えば、周期がΛ＝４０μｍの反射形の直線状グレーティングである光偏向手段５ａは、基準面１８に対して、グレーティングの溝（ｘ方向）に垂直な方向に、例えば、４５°傾けて配置している。これにより、対物レンズ４に入射する第１の波長の光１０ａと第２の波長の光１０ｂの光軸の、側面図における奥行き方向（ｘ軸方向）のずれを実質上無くすことができる。

【００６０】図６に示すように、本実施の形態の光学ヘッドの光偏向手段５ａである反射形グレーティング（周期Λ＝４０μｍ、溝深さＬ＝０．２６７μｍ、Ａｕの反射膜）の１次回折効率は、入射角θ２に依存しており、グレーティング５ａに対する第２の波長の光６ｂの入射角θ２は、$-50° \leqq \theta 2 \leqq 50°$ の関係を実質上満たす範囲であれば、ほぼ９０％以上の高い１次回折効率を実現できることが分かった。本実施の形態では、入射角θ２は例えば、４５°であるから、９２％の回折効率が得られた。

【００６１】（第４の実施の形態）本発明の第４の実施の形態の光学ヘッドについて、図７を用いて、上記第１の実施の形態と異なる点を中心に説明する。

【００６２】図７（ａ）は本発明の第４の実施の形態における光学ヘッドの基本構成と光の伝搬の様子を示す側面図、図７（ｂ）は本発明の第４の実施の形態における光学ヘッドの基本構成と光の伝搬の様子を示す裏面図である。

【００６３】本実施の形態の光学ヘッドは、例えば、９．５ｍｍ厚の超薄型構成の光学ヘッドを実現する。

【００６４】図７に示すように、光源・光検出器ユニット１７の窓側に、３ビームグレーティング、フォーカス／トラック誤差信号検出素子８、色収差補正グレーティング２０をこの順に配置している。立ち上げミラーの代わりに、３つの光学面を有するプリズム１９を用いている。

【００６５】プリズム１９は、情報記録媒体１１側を第１面（斜面）２１、光源１側を第２面（側面）２２、基準面１８側を第３面（底面）２３としたとき、プリズムの第３面２３に波長分離手段１２を設け、その下面に光偏向手段５を設けている。

【００６６】光源１からの出射光２は、３ビームグレーティング２４、フォーカス／トラック誤差信号検出素子８を透過し、色収差補正グレーティング２０で、例えば、1° 程度、ｚ軸方向に回折され、コリメータレンズ３に入射し、略平行光６になる。

【００６７】第１及び第２の波長の光６ａ、６ｂは、プリズム１９の第２面２２を透過して、第１面２１で全反射して、第３面１４の順に入射する。第１の波長の光６ａは、波長分離手段１２で反射され、第１面２１を透過して対物レンズ４に入射する。第２の波長の光６ｂは、波長分離手段１２を透過し、光偏向手段５で、偏向、反射され、光軸が平行になり、第１面２１を透過して対物レンズ４に入射する。

【００６８】このようにジグザグ状にプリズム１９内を伝搬させ、光軸を９０° 折り曲げる構成により、大幅に光学ヘッドの高さ（z軸方向サイズ）を小さくし、超薄型構成が可能になる。

【００６９】プリズム１９の仕様は、例えば、θｒ＝５．０°、θｐ＝２９．３°、θｑ＝１１４．３°で、底面２３の長さを４．４ｍｍとし、硝材としてＢＫ７を用いた。この場合、プリズム１９に入射するビーム径と出射するビーム径は等しいとしたビーム整形無しの構成であり、プリズム１９の硝材の屈折率をｎとし、底面の設置角度をθｒとすると、そのプリズムの底角の一方の 角度のθｐが、$\sin(\theta p - \theta r) = n \cdot \sin(4\theta p - 2\theta r - 90° - \theta')$ と、$n \cdot \sin\theta' = \sin(\theta p - \theta r)$ とを実質上満足し、底角の他方の角度θｑが、$\theta q = \theta + 90° - 2\theta r$ を実質上満たす関係にあるものとする。プリズム１９の設置角度は、例えば、θｒ＝５° としたが、実質上２° から８° の範囲内であれば、対物レンズ４の左端とプリズム１９との間隔に十分余裕が生まれ、好ましいことが分かった。

【００７０】本実施の形態では、光源１に半導体レーザを用いているため、高周波モジュールまたは自励発振により、典型的に１ｎｍ程度の波長帯域の広がりや環境温度の変化によって出射光の中心波長が変化するという現象が生じる。

【００７１】本実施の形態では、プリズム１９の側面２

２と斜面２１に光軸が斜めに入射するため、波長帯域に広がりがあると、屈折角が異なるという色分散が生じる。光路中に、回折光の回折角の変化が、プリズム１９での屈折角の変化と互いに相殺する方向に生じるように、色収差補正グレーティング２０を配置すると、色分散がうち消されて、光ディスク１１上に良好に集光させることが可能である。

【００７２】本発明者らは、プリズム１９を構成するガラスの硝材が低分散であるほうが良く、そのような場合、幅広い波長領域で、色収差をほぼ問題ならない程度まで相殺でき、同時に、色収差を補正するグレーティング２０の周期も大きくできるため、素子の製造が容易で高い回折効率が得られる効果があることを発見した。また波長変動は、第１の波長で±１０nmの範囲内であることが、現実的にはほとんどであり、その場合硝材のアッベ数は６４以上であれば、光ディスク１１上に色収差の影響の少ない光スポットを形成することができ、効果的であることも分かった。従って、硝材としては、ＢＫ７、ＦＣ５、ＦＫ５、ＦＣＤ１、ＦＣＤ１０、ＦＣＤ１００等が好ましい。

【００７３】本実施の形態の光学ヘッドは、色収差補正グレーティング２０として、均一周期のグレーティングを、光源１から、コリメータレンズ３までの収束光光路または発散光光路中に配置した。本発明者らは、このような収束光光路または発散光光路中に、色収差補正用のグレーティング２０を配置した場合、入射角により補正効果が異なる（光が傾いて入射した場合ほど、色収差補正効果が大きくなる）ことが分かったので、厳密には、出射光２の収束角にあわせて、ｚ軸方向のグレーティング２０の周期分布を変化させる必要があったが、開口数が０．３９以下の収束光光路中、または発散光光路中に配置されていた場合、対物レンズ４での光ディスク１１上のスポットは色収差で問題にならないことが分かり、均一周期のグレーティング２０を用いることが可能で、位置合わせや製造が楽であるという効果があった。

【００７４】以上、本発明の第１～第４の実施の形態の光学ヘッドについて述べてきたが、これらの実施の形態の光学ヘッド以外に、それぞれの光学ヘッドの構成を組み合わせた光学ヘッドも構成可能であり、同様の効果を有するのは言うまでもない。

【００７５】なお、実施の形態は光ディスクで説明したが、同様の情報記録再生装置で厚みや記録密度など複数の仕様の異なる媒体を再生できるように設計されたカード状やドラム状、テープ状の製品に応用することは本発明の範囲である。また、実施の形態の説明に用いた対物レンズとコリメータレンズは便宜上名付けたものであり、一般にいうレンズと同じである。

【００７６】

【発明の効果】以上説明したように、本発明によれば、複数の種類の情報記録媒体に対応でき、互いに近傍に配置した２波長の光源を具備する小型・薄型・軽量の光学ヘッドを実現することができる。

【図面の簡単な説明】

【図１】本発明の第１の実施の形態における光学ヘッドの基本構成と光の伝搬の様子を示す側面図と裏面図

【図２】本発明の第１の実施の形態の光学ヘッドにおける波長分離手段、光偏向手段の説明図

【図３】本発明の第１の実施の形態の光学ヘッドにおける第１と第２の波長に対する３ビームグレーティングの回折効率と溝深さの関係図

【図４】本発明の第２の実施の形態における光学ヘッドの基本構成と光の伝搬の様子を示す側面図と裏面図

【図５】本発明の第３の実施の形態における光学ヘッドの基本構成と光の伝搬の様子を示す側面図

【図６】本発明の第３の実施の形態の光学ヘッドにおけるグレーティング（光偏向手段）への入射角θ2と１次回折効率の関係図

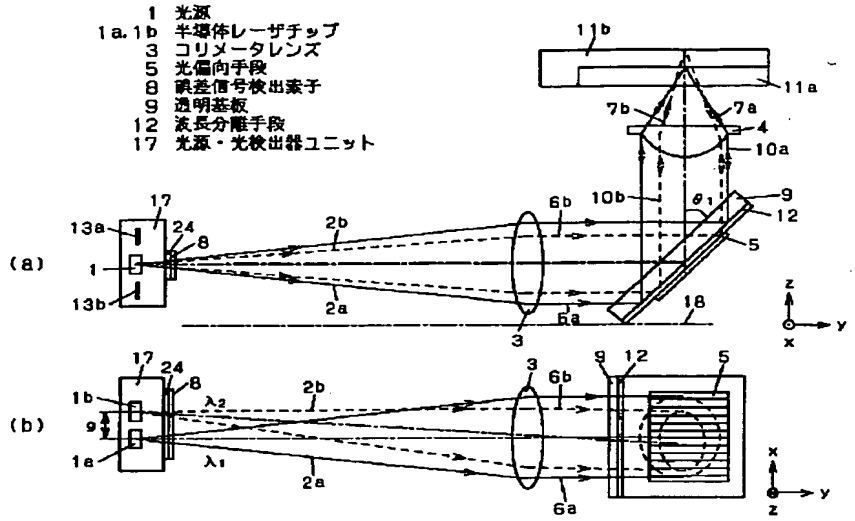
【図７】本発明の第４の実施の形態における光学ヘッドの基本構成と光の伝搬の様子を示す側面図と裏面図

【図８】従来の光学ヘッドの基本構成と光の伝搬の様子を示す側面図と上面図

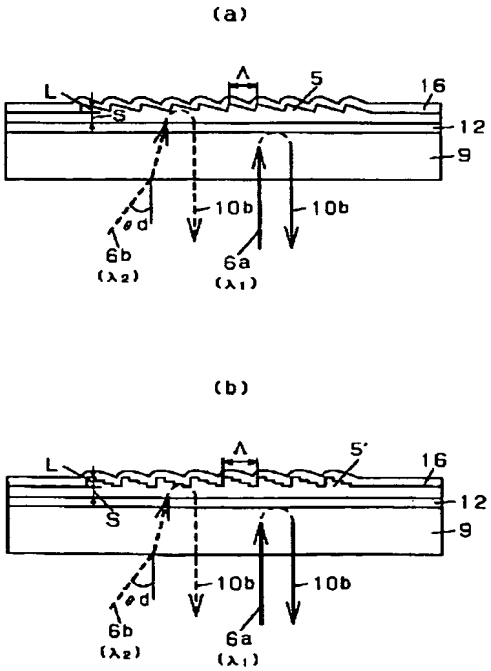
【符号の説明】

１　光源
２　出射光
３　コリメータレンズ
４　対物レンズ
５　グレーティング（光偏向手段）
６　平行光
７　収束光
８　フォーカス／トラック誤差信号検出素子
９　透明基板
１０　平行光
１１　情報記録媒体
１２　波長分離手段
１３　光検出器
１４　ビームスプリッタ
１５　立ち上げミラー
１６　反射膜
１７　光源・光検出器ユニット
１８　基準面
１９　プリズム
２０　色収差補正グレーティング
２１　プリズムの斜面（第１面）
２２　プリズムの側面（第２面）
２３　プリズムの底面（第３面）
２４　３ビームグレーティング

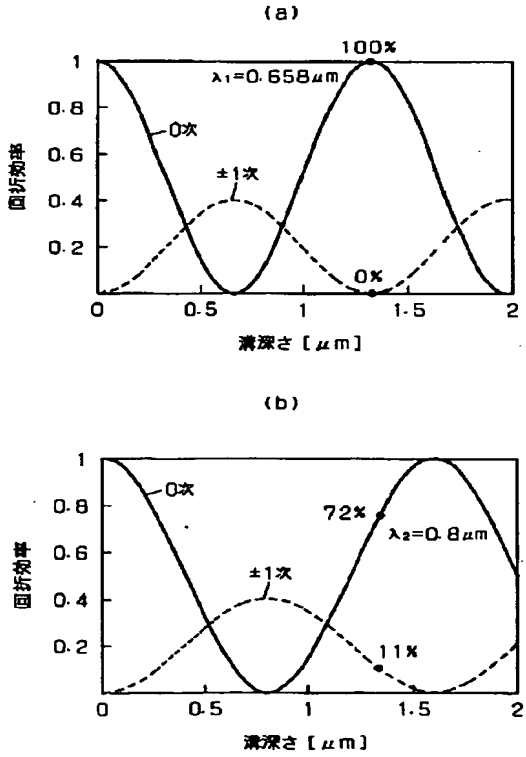
【図１】


1 光源
1a, 1b 半導体レーザチップ
3 コリメータレンズ
5 光偏向手段
8 誤差信号検出素子
9 透明基板
12 波長分離手段
17 光源・光検出器ユニット
(a)
(b)

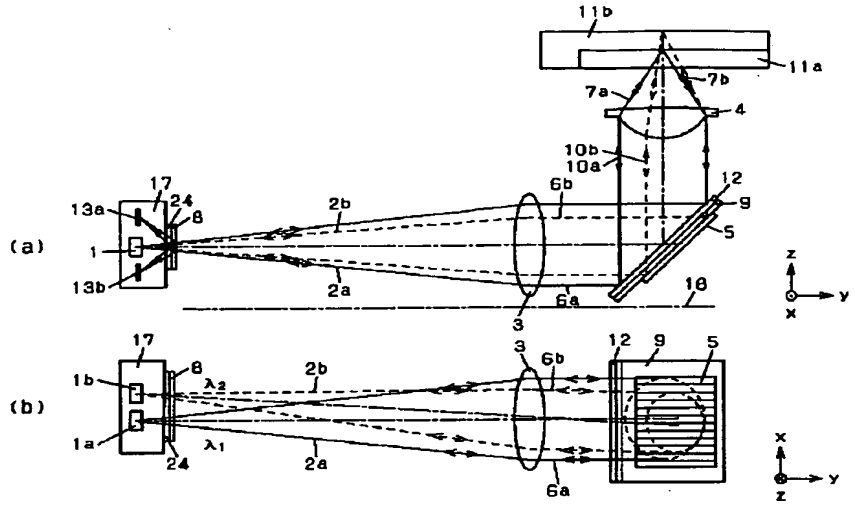
【図２】


(a)
(b)

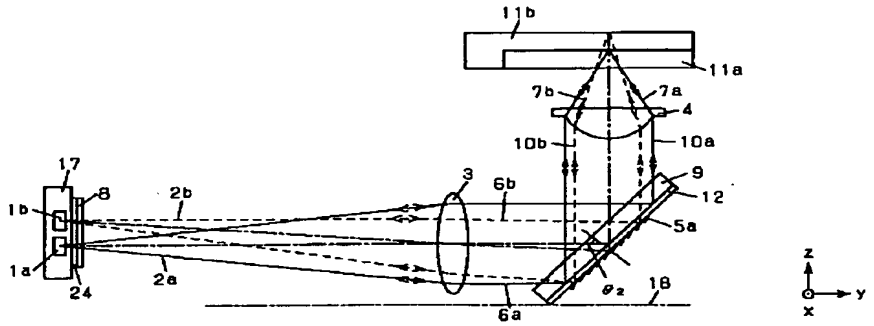
【図３】


(a)
(b)
回折効率
溝深さ［μm］
0次
±1次
100%
0%
72%
11%
λ1=0.658μm
λ2=0.8μm

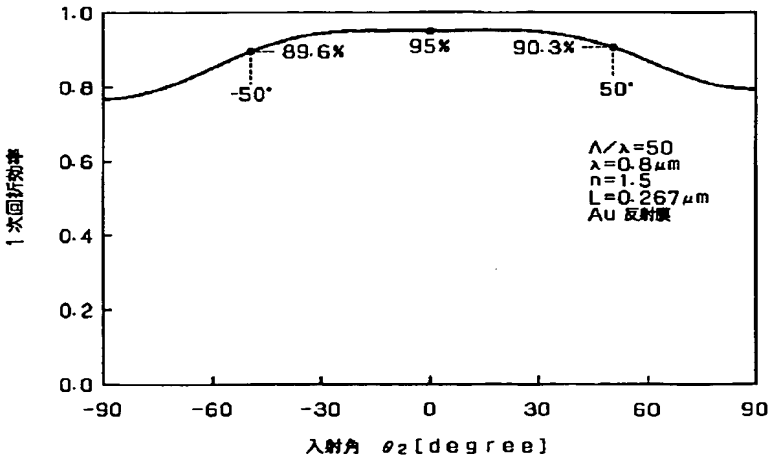
【図４】


11b
11a
7a
7b
4
10b
10a
12
9
5
6b
17
24
8
13a
1
13b
2b
2a
3
6a
16
(a)
(b)
1b
1a
λ2
λ1
z
y
x

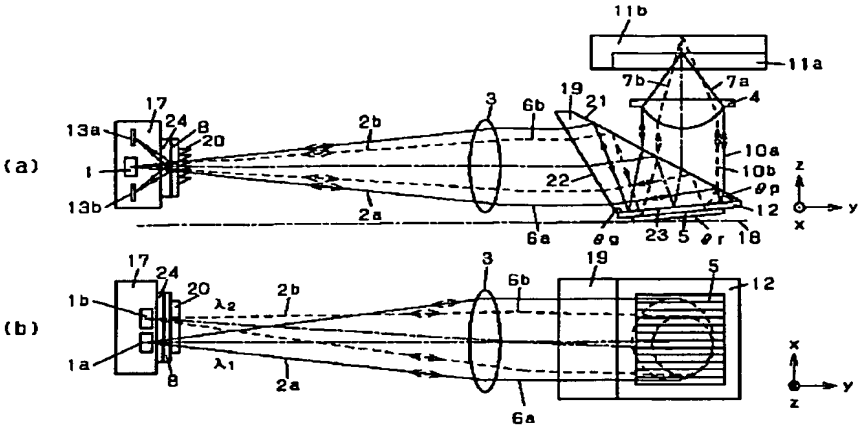
【図５】


11b
11a
7b
7a
4
10b
10a
9
12
5a
17
8
2b
3
6b
1b
1a
24
2a
6a
θ2
18
z
y
x

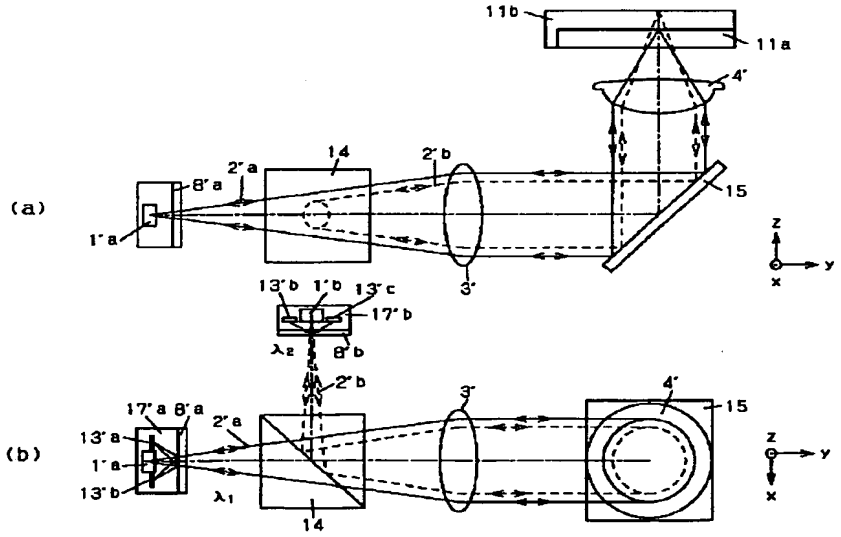
【図６】


1.0
0.8
0.6
0.4
0.2
0.0
89.6%
95%
90.3%
-50°
50°
Λ/λ=50
λ=0.8μm
n=1.5
L=0.267μm
Au 反射膜
1次回折効率
-90
-60
-30
0
30
60
90
入射角 θ2[degree]

【図７】



【図８】



フロントページの続き

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Ｆターム(参考)　5D119 AA02 AA41 BA01 BA02 BB01
BB04 EC03 EC27 EC47 FA08
JA21 JA22 LB04

Partial English Translation of J. P. Application No. 2000-163791 A

Application Number: 10337190
Application Date: November 11, 1998
Applicant: MATSUSHITA ELECTRIC INDUSTRIAL CO. LTD
Inventor: SHIONO TERUHIRO et al.
Title of the Invention: OPTICAL HEAD

Translation of column 8 of page 5 lines 3 to 18

【0038】

The present inventors have found that when the 3-beam grating 24 is a 2-level grating having a substantially rectangular shape or trapezoidal shape cross-section, as shown in Figure 3, when the depth of the groove substantially satisfies $\lambda 1 / (n-1) = 1.32$ μm wherein, for example, the first wavelength is $\lambda 1 = 0.658$ μm and the refractive index is $n = 1.5$, the grating allows almost all the light with the first wavelength to pass through (zero order diffracted light: ~100%), but, at this time, with respect to the second wavelength of, for example, $\lambda 2 = 0.8$ μm, the ratio of the zero order diffracted light to the first order diffracted light becomes approximately 7 : 1 that is an optimum ratio. Furthermore, the present inventors have found that the ratio R of the first wavelength to the second wavelength substantially satisfies the relationship: $0.75 \leq R \leq 0.9$ (in the above description, $R = 0.82$) and the depth of the groove is substantially $\lambda 1 / (n-1)$, a 3-beam tracking control can be performed effectively only with respect to the second wavelength without reduction of the efficiency in using light with the first wavelength.

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The 1st light source which carries out outgoing radiation of the light of the 1st wavelength, and the 2nd light source which carries out outgoing radiation of the light of the 2nd wavelength arranged near the 1st light source of the above, The optical head characterized by providing the optical deflection means which deviates so that the light and the optical axis of the 1st wavelength of the above with which the above 1st, a wavelength separation means to separate the light of the 2nd wavelength, and the light of the 2nd separated wavelength of the above were separated may become a real Kamitaira line.
[Claim 2] A wavelength separation means is an optical head according to claim 1 characterized by reflecting the light of the 1st wavelength on parenchyma and penetrating the light of the 2nd wavelength on parenchyma.
[Claim 3] A wavelength separation means is an optical head according to claim 2 which is wavelength separation multilayers.
[Claim 4] It is the optical head according to claim 2 which establishes a wavelength separation means on a transparence substrate, forms an optical deflection means in the opposed face of the above-mentioned transparence substrate, and is characterized by carrying out incidence of the light of the 1st and 2nd wavelength from a wavelength separation means side.
[Claim 5] It is the optical head according to claim 2 which establishes a wavelength separation means on a transparence substrate, establishes an optical deflection means on it, and is characterized by carrying out incidence of the light of the 1st and 2nd wavelength from the opposed face side of the above-mentioned transparence substrate.
[Claim 6] A transparence substrate is an optical head according to claim 4 or 5 characterized by arranging at 45 degrees on parenchyma to datum level.
[Claim 7] An optical deflection means is an optical head according to claim 1 characterized by being a diffracted-light study component.
[Claim 8] A diffracted-light study component is an optical head according to claim 7 characterized by being the straight-line-like grating of a reflex.
[Claim 9] The 1st light source and 2nd light source are an optical head according to claim 1 characterized by arranging in same-on parenchyma height to datum level.
[Claim 10] An optical deflection means is an optical head according to claim 9 which is the straight-line-like grating of a reflex and is characterized by leaning in the direction of a slot of the above-mentioned grating, and arranging to a datum plane.
[Claim 11] For a grating, channel depth L of the above-mentioned grating is [as opposed to / when a cross-section configuration is a serration configuration, sets to theta 1 the tilt angle leaned in the direction of a slot from the normal of datum level and sets the refractive index to n / the 2nd wavelength lambda 2] L=. Optical head according to claim 10 characterized by filling lambda2/(2ncostheta1) relation on parenchyma.
[Claim 12] A grating is optical HETSU according to claim 10 to which channel depth L of the above-mentioned grating is characterized by filling L=(p-1) lambda2/(2pncostheta1) relation on parenchyma to

the 2nd wavelength lambda 2 when a cross-section configuration is a multi-level configuration of the number p of level, sets to theta 1 the tilt angle leaned in the direction of a slot from the normal of datum level and sets the refractive index to n. DO.
[Claim 13] The 1st light source and 2nd light source are an optical head according to claim 1 characterized by arranging in the height direction to parenchyma top datum level.
[Claim 14] An optical deflection means is an optical head according to claim 13 which is the straight-line-like grating of a reflex and is characterized by leaning in the direction perpendicular to the slot of the above-mentioned grating, and arranging to a datum plane.
[Claim 15] The incident angle theta 2 of the light of the 2nd wavelength to a grating is an optical head according to claim 14 characterized by filling -50 degree<=theta2 <=50 degree relation on parenchyma.
[Claim 16] The 1st wavelength is an optical head according to claim 1 characterized by being smaller than the 2nd wavelength.
[Claim 17] The optical head according to claim 5 characterized by preparing a buffer layer between a wavelength separation means and an optical deflection means.
[Claim 18] It is the optical head according to claim 5 characterized by for an optical deflection means being the diffracted-light study component of a surface relief mold, and the distance from the pars basilaris ossis occipitalis of the slot to a wavelength separation means being larger than the 1st wavelength.
[Claim 19] A wavelength separation means is formed in the 3rd page of prism which has three optical surfaces which make a 1st page and light source side the 2nd page, and make a datum-level side the 3rd page for an information record-medium side. It is the optical head according to claim 2 which forms an optical deflection means in the inferior surface of tongue, carries out incidence of the light of the 1st and 2nd wavelength from the 2nd above-mentioned page, and is characterized by passing in order of the 1st above-mentioned page, the 3rd page, and the 1st page.
[Claim 20] The optical head according to claim 19 characterized by preparing at least the chromatic-aberration amendment grating which reduces the chromatism of prism into the optical path of the light of the 1st wavelength.
[Claim 21] A grating is an optical head according to claim 8 characterized by making the period small, so that the distance of the 1st light source and the 2nd light source is large.
[Claim 22] R fills 0.75<=R<=0.9 on parenchyma. the ratio of magnitude to the 2nd wavelength of the 1st wavelength -- When 3 beam grating was prepared into the 1st or 2nd light source and the optical path of a wavelength separation means, the cross section is a real quadrature form or a trapezoid configuration, the 1st wavelength lambda 1 is carried out and a refractive index is set to n, The channel depth is an optical head according to claim 1 characterized by being lambda1/(n-1) on parenchyma.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The side elevation and rear-face Fig. showing the basic configuration of an optical head and the situation of propagation of light in the gestalt of operation of the 1st of this invention
[Drawing 2] The explanatory view of the wavelength separation means in the optical head of the gestalt of operation of the 1st of this invention, and an optical deflection means
[Drawing 3] The related Fig. of the 1st, the diffraction efficiency of 3 beam grating to the 2nd wavelength, and a channel depth in the optical head of the gestalt of operation of the 1st of this invention
[Drawing 4] The side elevation and rear-face Fig. showing the basic configuration of an optical head and the situation of propagation of light in the gestalt of operation of the 2nd of this invention
[Drawing 5] The side elevation showing the basic configuration of an optical head and the situation of propagation of light in the gestalt of operation of the 3rd of this invention
[Drawing 6] The related Fig. of the incident angle theta 2 to a grating (optical deflection means), and primary diffraction efficiency in the optical head of the gestalt of operation of the 3rd of this invention
[Drawing 7] The side elevation and rear-face Fig. showing the basic configuration of an optical head and the situation of propagation of light in the gestalt of operation of the 4th of this invention
[Drawing 8] The side elevation and plan showing the basic configuration of the conventional optical head, and the situation of propagation of light
[Description of Notations]
1 Light Source
2 Hikaru Idei
3 Collimator Lens
4 Objective Lens
5 Grating (Optical Deflection Means)
6 Parallel Light
7 Convergence Light
8 Focus / Truck Error Signal Sensing Element
9 Transparence Substrate
10 Parallel Light
11 Information Record Medium
12 Wavelength Separation Means
13 Photodetector
14 Beam Splitter
15 Starting Mirror
16 Reflective Film
17 Light Source and Photodetector Unit
18 Datum Level
19 Prism

20 Chromatic-Aberration Amendment Grating
21 Slant Face of Prism (1st Page)
22 **** of Prism (2nd Page)
23 Base of Prism (3rd Page)
24 3 Beam Grating

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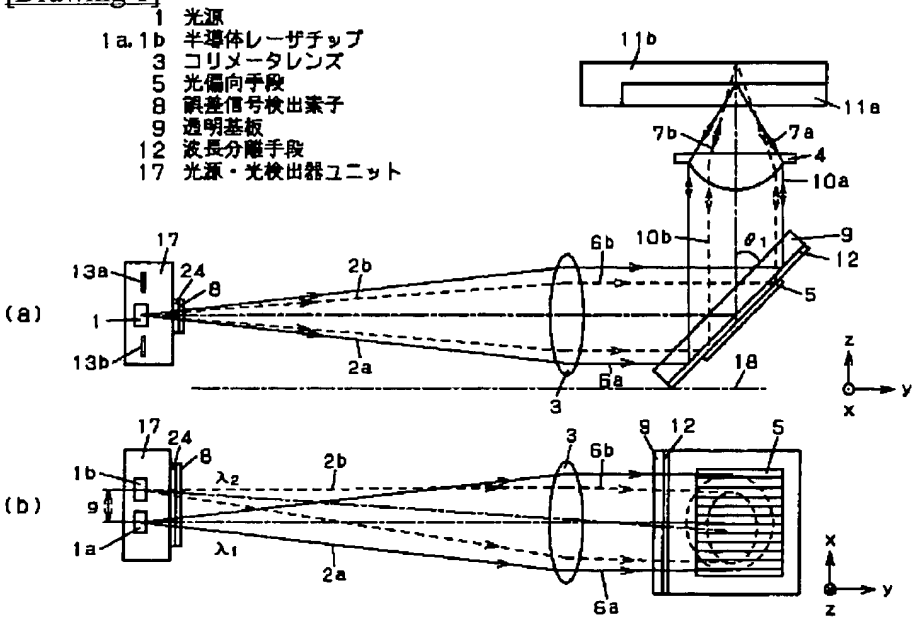
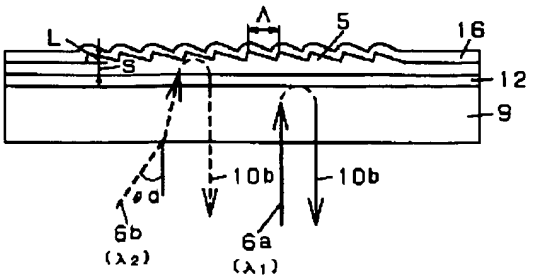
DRAWINGS

[Drawing 1]



[Drawing 2]

(a)



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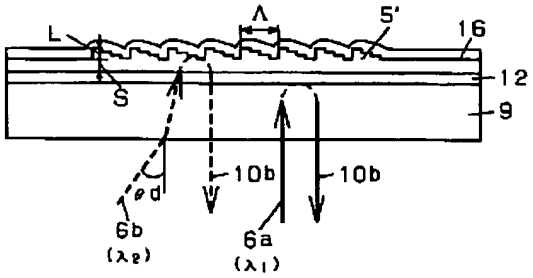
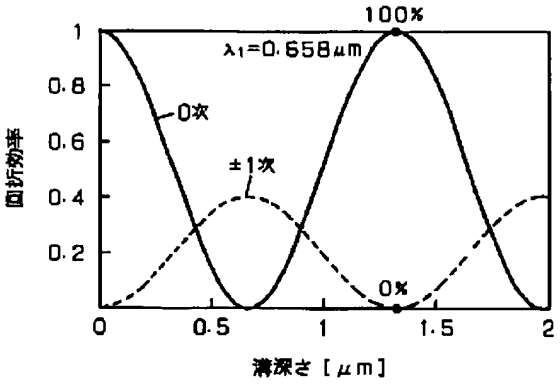


[Drawing 3]

(a)



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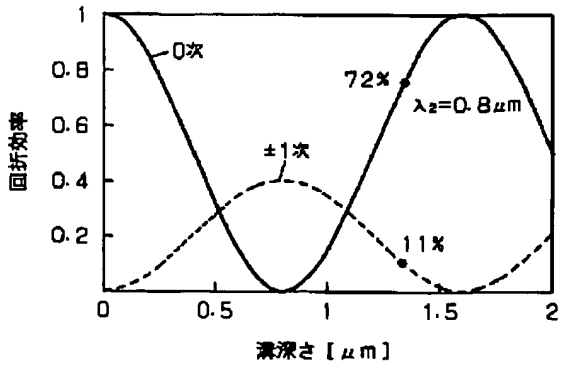
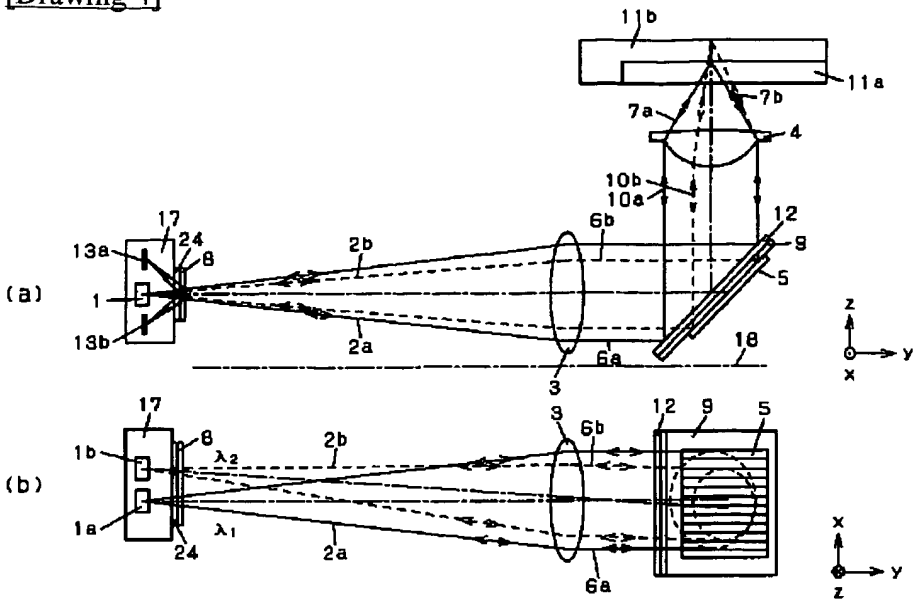
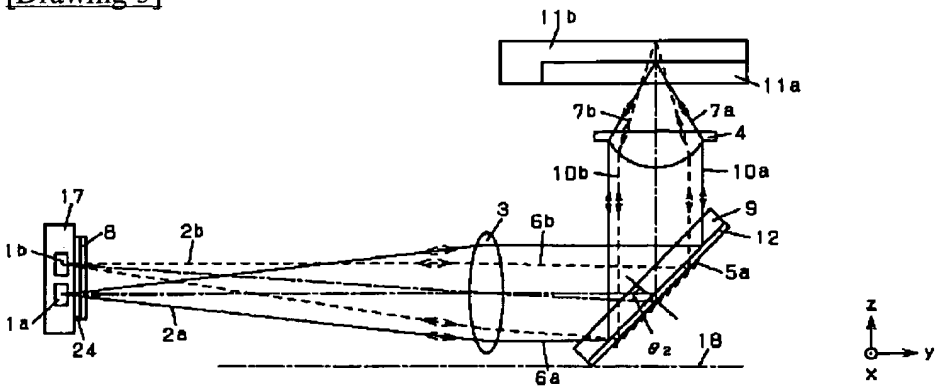


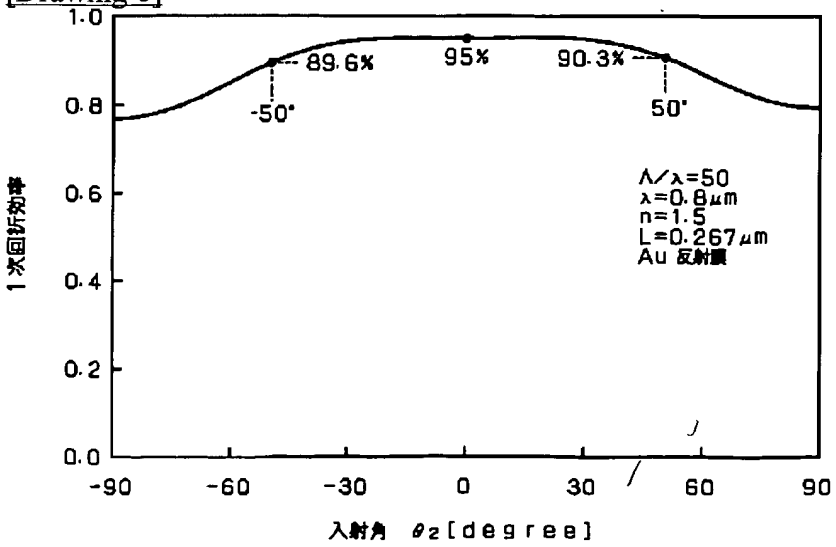
[Drawing 4]



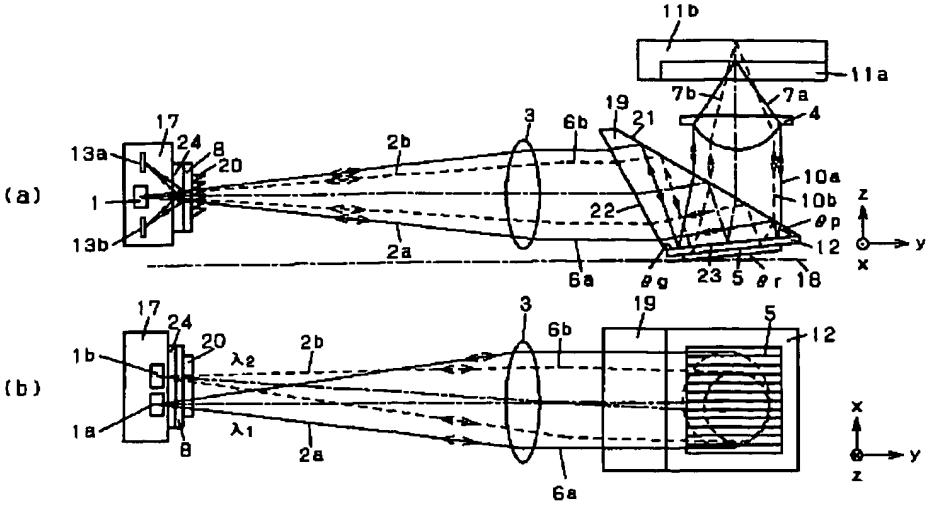
[Drawing 5]



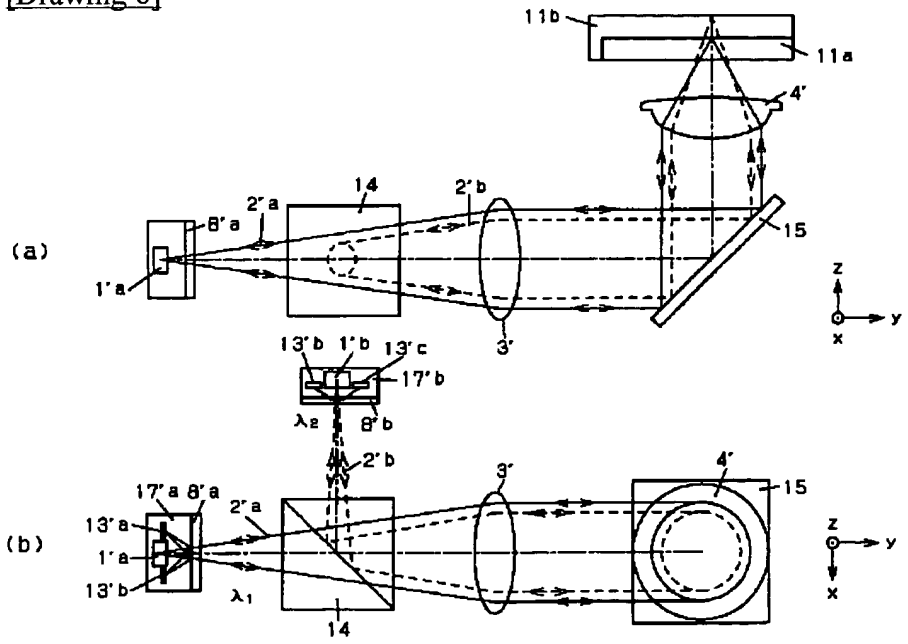
[Drawing 6]



[Drawing 7]



[Drawing 8]



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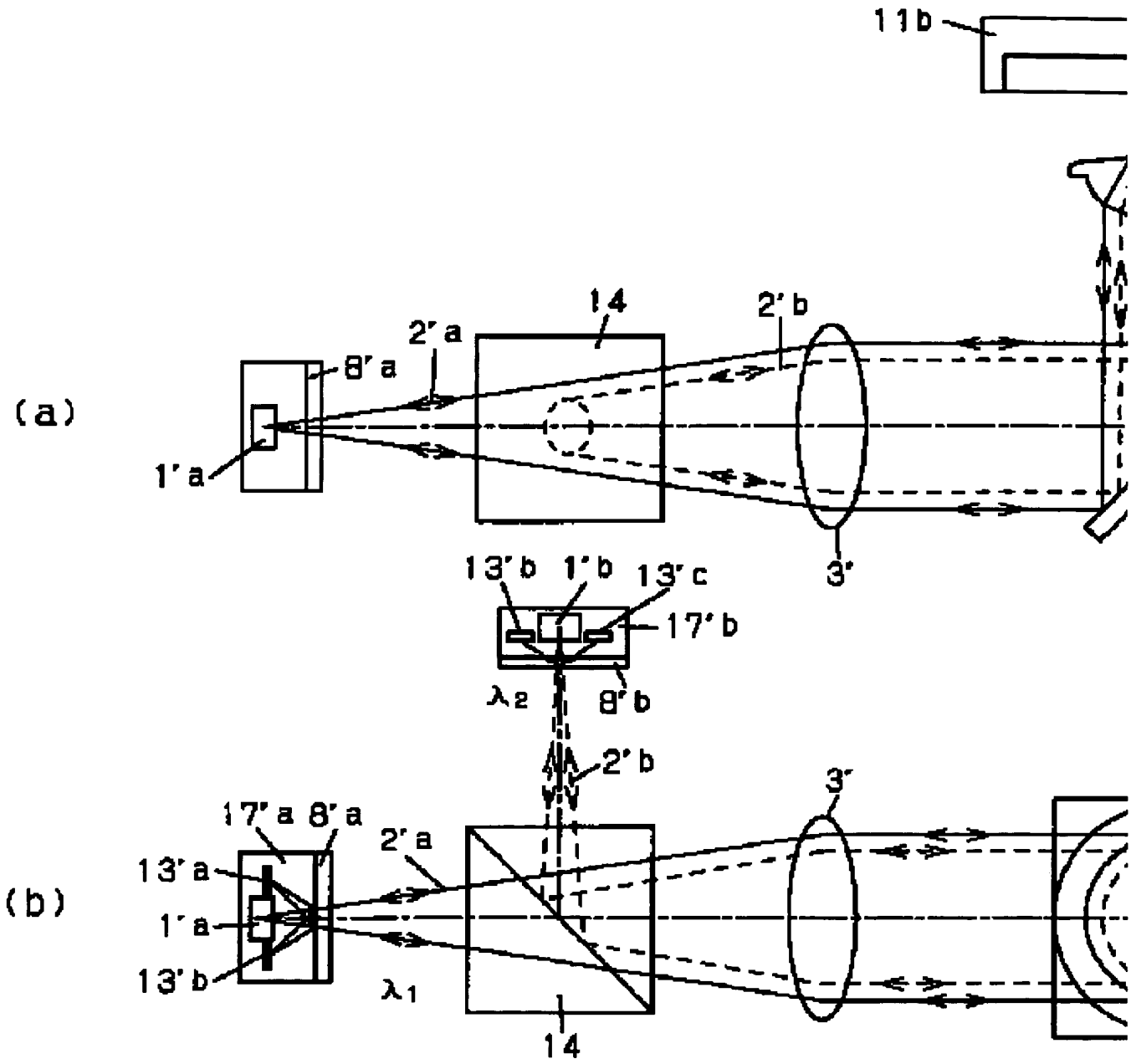
11b
(a)
14
2'b
2'a
8'a
1'a
3'
13'b
1'b
13'c
17'b
λ2
8'b
2'b
(b)
3'
17'a
8'a
2'a
13'a
1'a
13'b
λ1
14

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] About the optical head of an optical record regenerative apparatus, especially, this invention can respond to the information record medium of two or more classes, and relates to small and the thin shape, and the lightweight optical head possessing two waves of light sources mutually arranged to near.
[0002]
[Description of the Prior Art] There is an optical head as an important component part for reading the signal of information record media, such as optical disks, such as a compact disk (CD) and DVD, and optical card memory. An optical head needs to be equipped with controlling mechanisms, such as not only a signal detection function but a focus servo, a tracking servo, etc., in order to take out a signal from an optical record medium.
[0003] Since it corresponded to DVD, CD, or two or more information record media of CD-R, there was an optical head in which the two light sources were carried. The optical head which has two waves of conventional light sources is shown in drawing 8 .
[0004] The 1st light source 1 '2nd light source which carries out outgoing radiation of the 2nd wavelength lambda 2 corresponding to a, CD, or CD-R' 1 b which carries out outgoing radiation of the 1st wavelength lambda 1 corresponding to DVD It is built in respectively separate photodetector unit 17 'a, 17' the light source and b. It is multiplexed by the beam splitter 14, and laser beam 2'a by which outgoing radiation was carried out from them, and 2'b become parallel by collimator lens 3', and can bend 90 degrees of opticals axis by the starting mirror 15. By objective lens 4' It is condensed by the optical disk 11 (DVD 11 a and CD 11b).
[0005] truck error signal detector 8 'a, 8' the focus/b which turned up the signal light reflected with the optical disk 11 to the reverse sense, was separated spectrally by the beam splitter 14, and was prepared in the aperture of the light source and photodetector unit 17 'a, 17' b -- photodetector 13' -- it is condensed upwards and a regenerative signal is read. Moreover, control of a focus / truck servo is performed, and it is stabilized, and enables it to read a signal.
[0006]
[Problem(s) to be Solved by the Invention] However, since it corresponded to two or more information record media, such as DVD, and CD or CD-R, the light source was built in the separate package (the light source and photodetector unit), with the conventional configuration which is compounded by a beam splitter etc., the limitation was in small and thin shape, and lightweight-ization of an optical head, and the technical problem that alignment was complicated and the further simplification and simplification of assembly moreover could not be performed occurred.
[0007] This invention is made in order to solve said technical problem in the conventional technique, especially, can respond to the information record medium of two or more classes, and aims at offering small and the thin shape, and the lightweight optical head possessing two waves of light sources mutually arranged to near.

[0008]
[Means for Solving the Problem] In order to attain said purpose, invention of this invention according to claim 1 The 1st light source which carries out outgoing radiation of the light of the 1st wavelength, and the 2nd light source which carries out outgoing radiation of the light of the 2nd wavelength arranged near the 1st light source of the above, It is the optical head characterized by providing the optical deflection means which deviates so that the light and the optical axis of the 1st wavelength of the above with which the above 1st, a wavelength separation means to separate the light of the 2nd wavelength, and the light of the 2nd separated wavelength of the above were separated may become a real Kamitaira line. The optical head using two waves of light sources arranged mutually in near thereby, for example which can respond to the information record medium of two or more classes by the small light weight can be obtained.
[0009] Moreover, invention of this invention according to claim 2 is an optical head according to claim 1 which a wavelength separation means reflects [head] the light of the 1st wavelength on parenchyma, and makes the light of the 2nd wavelength penetrate on parenchyma. Thereby for example, a compact configuration can be realized.
[0010] Moreover, invention of this invention according to claim 3 is an optical head according to claim 2 whose wavelength separation means are wavelength separation multilayers.
[0011] Thereby, it can integrate to other optics with a thin shape, and structure becomes stability.
[0012] Moreover, invention of this invention according to claim 4 establishes a wavelength separation means on a transparence substrate, an optical deflection means is formed in the opposed face of the above-mentioned transparence substrate, and the light of the 1st and 2nd wavelength is an optical head according to claim 2 which carries out incidence from a wavelength separation means side. Thereby, the alignment of an optic becomes easy and structure can be stabilized.
[0013] Moreover, invention of this invention according to claim 5 establishes a wavelength separation means on a transparence substrate, an optical deflection means is established on it, and the light of the 1st and 2nd wavelength is an optical head according to claim 2 which carries out incidence from the opposed face side of the above-mentioned transparence substrate. While the alignment of an optic becomes easy and structure is stable by this, the center position of the maximum reinforcement of the light of the 1st and the 2nd wavelength which becomes a real Kamitaira line can be brought close, and a good condensing spot can be formed on an optical disk.
[0014] Moreover, for a transparence substrate, invention of this invention according to claim 6 is an optical head according to claim 4 or 5 to which it arranges at 45 degrees on parenchyma to datum level. Thereby, the optic united for example, with the transparence substrate can serve as a starting mirror.
[0015] Moreover, invention of this invention according to claim 7 is an optical head according to claim 1 whose optical deflection means is a diffracted-light study component. Thereby, for example, an optical deflection means can perform thin lightweight-ization.
[0016] Moreover, invention of this invention according to claim 8 is an optical head according to claim 7 whose diffracted-light study component is the straight-line-like grating of a reflex. Thereby, manufacture of for example, an optical deflection means is easy, and alignment can obtain an easy optical head.
[0017] Moreover, invention of this invention according to claim 9 is an optical head according to claim 1 which arranges the 1st light source and 2nd light source in same-on parenchyma height to datum level. Thereby, arrangement of the 1st and the 2nd light source becomes easy.
[0018] Moreover, an optical deflection means is the straight-line-like grating of a reflex, and invention of this invention according to claim 10 is an optical head according to claim 9 which leans in the direction of a slot of the above-mentioned grating, and is arranged to a datum plane. The configuration which can make primary diffraction efficiency of a grating high by this is possible.
[0019] Moreover, when invention of this invention according to claim 11 sets to theta 1 the tilt angle to which a grating is a serration configuration and the cross-section configuration leaned it in the direction of a slot from the normal of datum level and sets the refractive index to n, Channel depth L of the above-mentioned grating is L= to the 2nd wavelength lambda 2. It is the optical head according to claim 10

characterized by filling lambda2/(2ncostheta1) relation on parenchyma. Thereby, primary diffraction efficiency of a grating can be made the highest.
[0020] Moreover, when invention of this invention according to claim 12 sets to theta 1 the tilt angle to which a grating is the multi-level configuration of the number p of level, and the cross-section configuration leaned it in the direction of a slot from the normal of datum level and sets the refractive index to n, It is the optical head according to claim 10 characterized by channel depth L of the above-mentioned grating filling L= lambda(p-1)2/(2pncostheta1) relation on parenchyma to the 2nd wavelength lambda 2. Thereby, manufacture of a grating is easy and can make primary diffraction efficiency the highest.
[0021] Moreover, invention of this invention according to claim 13 is an optical head according to claim 1 which arranges the 1st light source and 2nd light source in the height direction to parenchyma top datum level. Thereby, arrangement of the 1st light source and the 2nd light source can be made easy.
[0022] Moreover, an optical deflection means is the straight-line-like grating of a reflex, and invention of this invention according to claim 14 is an optical head according to claim 13 which leans in the direction perpendicular to the slot of the above-mentioned grating, and is arranged to a datum plane. Thereby, a gap of the depth direction in the side elevation of the optical axis of the light of the 1st wavelength which carries out incidence to an objective lens, and the light of the 2nd wavelength can be lost on parenchyma.
[0023] Moreover, it is the optical head according to claim 14 characterized by the incident angle theta 2 of the light [as opposed to a grating in invention of this invention according to claim 15] of the 2nd wavelength filling -50 degree<=theta2 <=50 degree relation on parenchyma. Thereby, primary diffraction efficiency of a grating can be made high, for example, it can be made to 90% or more.
[0024] Moreover, it is optical HETSU according to claim 1 to which invention of this invention according to claim 16 is characterized by the 1st wavelength being smaller than the 2nd wavelength. DO ****. Thereby for example, efficiency for light utilization of the 1st wavelength with the wavelength smaller generally that the outgoing radiation effectiveness of the light source is bad can be made larger than the efficiency for light utilization of the 2nd wavelength.
[0025] Moreover, invention of this invention according to claim 17 is an optical head according to claim 5 which prepares a buffer layer between a wavelength separation means and an optical deflection means. The effect of the light of the 1st wavelength to the optical deflection means which oozes out for example, from a wavelength separation means can be lost by this, and efficiency for light utilization of the light of the 1st wavelength can be improved.
[0026] Moreover, the optical deflection means of invention of this invention according to claim 18 is the diffracted-light study component of a surface relief mold, and the distance from the pars basilaris ossis occipitalis of the slot to a wavelength separation means is a larger optical head according to claim 5 than the 1st wavelength. The effect of the light of the 1st wavelength to the optical deflection means which oozes out for example, from a wavelength separation means can be lost by this, and efficiency for light utilization of the light of the 1st wavelength can be improved.
[0027] Invention of this invention according to claim 19 an information record-medium side Moreover, the 1st page, A wavelength separation means is formed in the 3rd page of prism which has three optical surfaces which make a light source side the 2nd page and make a datum-level side the 3rd page, and an optical deflection means is formed in the inferior surface of tongue. The light of the 1st and 2nd wavelength It is the optical head according to claim 2 which carries out incidence and which is passed from the 2nd above-mentioned page in order of the 1st above-mentioned page, the 3rd page, and the 1st page. Thereby, an optical head can be made into a thin shape by the configuration which takes the zigzag propagation in prism for an optical path.
[0028] Moreover, invention of this invention according to claim 20 is an optical head according to claim 19 which prepares at least the chromatic-aberration amendment grating which reduces the chromatism of prism into the optical path of the light of the 1st wavelength. Thereby, when semiconductor laser light is used as an outgoing radiation light from the light source, even if the main wavelength of outgoing radiation light changes with the breadth of an about several nm wavelength band and the change of

environmental temperature by the high frequency module or self-oscillation, the chromatism of prism can be reduced and a good condensing spot can be obtained in respect of an optical disk.
[0029] Moreover, the grating of invention of this invention according to claim 21 is an optical head according to claim 8 to which the distance of the 1st light source and the 2nd light source makes the period small, so that it is large. It is possible to make the optical axis of two waves of light sources into a real Kamitaira line to the distance of the arbitration of the 1st light source and the 2nd light source by this.
[0030] R fills 0.75<=R<=0.9 on parenchyma. moreover, the ratio [as opposed to the 2nd wavelength of the 1st wavelength in invention of this invention according to claim 22] of magnitude -- When 3 beam grating was prepared into the 1st or 2nd light source and the optical path of a wavelength separation means, the cross section is a real quadrature form or a trapezoid configuration, the 1st wavelength lambda 1 is carried out and a refractive index is set to n, the channel depth is an optical head according to claim 1 which is lambda1/(n-1) on parenchyma. Thereby, the efficiency for light utilization over the light of the 1st wavelength can perform tracking control with 3 beam tracking method to the light of the 2nd wavelength, without dropping.
[0031]
[Embodiment of the Invention] (Gestalt of the 1st operation) About the optical head of the gestalt of operation of the 1st of this invention, from drawing 1 to drawing 3 is used, and an axis of coordinates is explained to a detail, as shown in drawing.
[0032] The side elevation showing the basic configuration of an optical head and the situation of propagation of light, [in / in drawing 1 (a) / the gestalt of operation of the 1st of this invention] The rear-face Fig. showing the basic configuration of an optical head and the situation of propagation of light, [in / in drawing 1 (b) / the gestalt of operation of the 1st of this invention] The explanatory view of a wavelength separation means [in / in drawing 2 (a) / the optical head of the gestalt of this operation], and an optical deflection means, A wavelength separation means [in / in drawing 2 (b) / the optical head of further others of the gestalt of this operation], The explanatory view of an optical deflection means, the related Fig. [in / in drawing 3 (a) / the optical head of the gestalt of operation of the 1st of this invention] of the diffraction efficiency of 3 beam grating, and a channel depth to the 1st wavelength, Drawing 3 (b) is the related Fig. of the diffraction efficiency of 3 beam grating, and a channel depth to the 2nd wavelength in the optical head of the gestalt of operation of the 1st of this invention.
[0033] The optical head of the gestalt of this operation realizes small and the thin shape, and the lightweight optical head which carry two waves of light sources arranged mutually in near, for example, can respond to two or more information record media, such as DVD, and CD, CD-R.
[0034] As shown in drawing 1 , two waves of light sources 1 and a photodetector 13 are built in in the light source and the photodetector unit 17. As the light source For example, semiconductor laser chip 1b which carries out outgoing radiation of the 2nd wavelength lambda2=0.8micrometer optical 2b to semiconductor laser chip 1a which carries out outgoing radiation of the 1st wavelength lambda1=0.658micrometer optical 2a is arranged in near which about 400 micrometers of distance g of those center positions left, for example.
[0035] The light sources 1a and 1b do not usually emit light to coincidence, and carry out outgoing radiation of the light alternatively according to the class of optical disk 11. With the gestalt of this operation, to datum level 18 (inferior surface of tongue of an optical head parallel to xy flat surface), two waves of light sources 1 are arranged so that it may become same-on parenchyma height. With such arrangement, arrangement becomes easy. Since optics, such as a beam splitter like the conventional example, are omissible by arranging mutually the semiconductor laser chip used as two waves of light sources 1 to near,-izing of the optical head can be carried out [simplification, small a thin shape, and lightweight], and the alignment at the time of being assembly becomes easy.
[0036] Laser beam 2a or 2b by which outgoing radiation was alternatively carried out from the light source 1 Penetrated 3 beam grating 24 prepared in the aperture side of the light source and the photodetector unit 17, and united with it, for example, the focus / truck error signal sensing element 8

which is a hologram component are penetrated (zero-order diffracted-light use). For example, as for the light of about 3mm and the 2nd wavelength, the light of the 1st wavelength turns into [a beam diameter] the about 2.2mm abbreviation parallel light 6a and 6b by the collimator lens 3 with a focal distance of 20mm. At this time, it has arranged so that it may become parallel [the optical axis of the light 2a and 6a of the 1st wavelength which connects the core of a collimator lens 3 to light source 1a] to the y-axis, and the optical axis of 2b and 6b which connect the core of a collimator lens 3 to light source 1b is parallel to datum level 18, and leans 1.15 degrees as opposed to the direction of the y-axis (refer to drawing 1 (b)).

[0037] 3 beam grating 24 is what diffracted only to optical 2b of the 2nd wavelength, became three beams (zero-order, primary [**] diffracted light), and was prepared so that tracking detection could be carried out, and only merely passes like a transparence substrate to optical 2a of the 1st wavelength. Since especially the tracking detecting method at the time of reading the optical disk of CD-R with the light of the 2nd wavelength has the desirable 3 beam method and the tracking detecting method at the time of reading the optical disk of DVD with the light of the 1st wavelength has the desirable phase contrast method, if it is made such a configuration, tracking detection can be effectively performed to those optical disks.

[0038] If the cross section of 3 beam grating 24 is made into 2 level grating which is a real quadrature form or a trapezoid configuration, this invention persons As shown in drawing 3 , 1st wavelength lambda1=0.658micrometer and a refractive index n= 1.5 are received. The channel depth It is related with the light of the 1st wavelength on parenchyma at the time of lambda1/(n-1) =1.32micrometer. almost -- all -- penetrating (zero-order diffracted-light -100%) -- it found out that the ratio of the zero-order diffracted light and the primary diffracted light became about [optimal] about 7:1 [at this time, for example, the light of the 2nd wavelength lambda2=0.8micrometer wavelength,]. furthermore, the ratio [as opposed to the 2nd wavelength of the 1st wavelength in this invention persons] of magnitude -- R -- 0.75<=R<=0.9 -- a parenchyma top -- filling (in the above-mentioned description) When R= 0.82 and its channel depth were lambda1/(n-1) on parenchyma, they found out that 3 beam tracking control could do efficiency for light utilization of the 1st wavelength effectively only to the 2nd wavelength, without hardly dropping.

[0039] Optical 6a of the 1st wavelength has been arranged at 45 degrees on parenchyma to datum level 18. For example, the front face in which the nonreflective coat (with no illustration) of the transparence substrate 9 which is glass with a thickness of about 1mm etc. was established is penetrated. It was formed in the rear face, for example, it is reflected on parenchyma by the wavelength separation means 12 which is wavelength separation multilayers, 90 degrees of opticals axis are bent on parenchyma, and it is set to parallel light 10a of the direction of the z-axis, and incidence is carried out to an objective lens 4, and it is set to convergence light 7a, and is condensed on DVD11a which is an optical disk.

[0040] Although optical 6b of the 2nd wavelength also penetrates the inside of the transparence substrate 9 Furthermore, carried out real superior transit also of the wavelength separation means 12, and it was formed on it (drawing 1 (a) inferior surface of tongue). for example, incidence is carried out to the optical deflection means 5 of the reflex which is the straight-line-like blaze-ized grating (a period is 40 micrometers) of a reflex, and it deviates, only the direction component of a x axis a deviation -- is reflected, an optical axis becomes parallel to the parenchyma top z-axis, similarly incidence is carried out to an objective lens 4, and it is condensed by CD11b. As a result of the optical axis of optical 10a of the 1st wavelength and the optical axis of optical 10b of the 2nd wavelength becoming parallel, condensing with an objective lens 4 good is possible, without the optical axis which carries out incidence to an objective lens 4 becoming perpendicular, and comatic aberration and astigmatism arising also to which wavelength. Moreover, it becomes one accumulation component, and structure can be stable, and can become easy [alignment], and moreover the wavelength separation means 12 and the optical deflection means 5 which were united with the transparence substrate 9 can be started, and can serve as a mirror.

[0041] By having prepared combining the wavelength separation means 12 and the optical deflection means 5, the period of the grating which is the optical deflection means 5 is made greatly, and is easy to

manufacture.
[0042] The laser beam 7 reflected by the optical disk 11 is turned up to hard flow, passes an objective lens 4 and the transparence substrate 9, only a x-axis component is deflected by the optical deflection means 5, only optical 10b of the 2nd wavelength passes a collimator lens 3, and is divided by a focus / truck error signal sensing element 8 (primary secondary diffracted-light use), and is detected by the photodetector 13.
[0043] In the gestalt of this operation, although the wavelength separation multilayers of the structure which deposited the dielectric thin film of SiO2 and TiO2 by turns on the transparence substrate 9 were used for the wavelength separation means 12, for example, with such a multilayers configuration, it could do the wavelength separation means in less than several micrometers thinness, and was effective in a transparence substrate and accumulation unification being possible and structure becoming stability. Moreover, since the wavelength separation means 12 can be done very thinly, the maximum location of optical 10a of the 1st wavelength and optical 10b of the 2nd wavelength on the strength which carries out incidence to an objective lens 4 can be mostly set as a center section (in addition, in drawing 1 (a), since the wavelength separation means 12 is exaggerated and it is drawing thickly, shifted).
[0044] Moreover, the straight-line-like grating of a reflex which is a diffracted-light study component was used for the optical deflection means 5. By using the optical deflection means of a diffracted-light study component, thin-shape-izing, lightweight-izing, and low-pricing can be attained for an optical head.
[0045] In the gestalt of this operation, to a datum plane 18, the grating 5 was leaned in the direction of a slot, and has been arranged. Thus, by arranging, it is effective in the same high primary diffraction efficiency as the case where vertical incidence is carried out effectually being acquired (for example, the high primary diffraction efficiency to which theta2=0 is equivalent with the graph of drawing 6 mentioned later, for example, 95%, is acquired).
[0046] As shown in drawing 2 , a grating 5 or 5' A reflecting layer 16 is formed in a front face with a surface relief mold. A cross-section configuration, respectively A serration configuration (drawing 2 (a)), When it is a multi-level configuration (drawing 2 (b) is 4 level configuration), the tilt angle leaned in the direction of a slot from the normal (z-axis) of datum level 18 is set to theta 1 and the refractive index is set to n, Channel depth L of the above-mentioned grating is L= to the 2nd wavelength lambda 2. It was made to fill relation (lambda2/(2ncostheta1) (in the case of a serration configuration), and L= lambda(p-1)2/(2pncostheta1) (for p to be the number of level at a multi-level configuration)) on parenchyma. Primary diffraction efficiency was able to be made into max (from 95% to for example, 98%) by making it the channel depth depending on such a tilt angle. As a reflecting layer 16, it is possible to use the multilayers of metal layers, such as Ag, and Au, aluminum, or a dielectric.
[0047] Moreover, a grating 5 or distance s from the base of the slot of 5' to a wavelength separation means was made larger than the 1st wavelength lambda 1. Although the phenomenon which oozes out from there very slightly starts in case optical 6a of the 1st wavelength reflects with the wavelength separation means 12, by such configuration, the exudation to the slot of a grating 5 or 5' is abolished, it becomes impossible to diffract optical 6a of the 1st wavelength at all, and it can improve efficiency for light utilization. Moreover, the same effectiveness is acquired even if it prepares buffer layers, such as SiO two-layer thicker than the 1st wavelength, between the wavelength separation means 12 and the optical deflection means 5.
[0048] The period lambda of a grating 5 is 40 micrometers, and in the case of lambda2=0.8micrometer, the primary angle of diffraction over the wavelength lambda 2 at this time becomes thetad=1.15 degree, and can amend the include angle of an optical-axis gap of the light of the 2nd wavelength exactly. In addition, angle-of-diffraction thetad is the include angle (according to the focal distance f of a collimator lens 3, and the center distance g of the light source) of an optical-axis gap of the light of the 2nd wavelength. What is necessary is just to set up the period lambda of a grating 5 so that this formula may be satisfied on parenchyma since it is possible to make the optical axis over both wavelength parallel by making it the same and an angle of diffraction is expressed with thetad=sin-1 (lambda2/lambda) that it is expressed with tan-1 (g/f). The grating which is the optical deflection means 5 of the gestalt of this

operation was imprinted and produced from metal mold by 2P well-known law on the transparence substrate 12 with which the wavelength separation means 9 was formed using ultraviolet-rays hardening resin, for example.
[0049] Moreover, although light with larger wavelength was made into the light of the 2nd wavelength and it was made to deviate with the optical deflection means 5 with the gestalt of this operation, since the way of the semiconductor laser light source which carries out outgoing radiation of the light with large wavelength generally has good outgoing radiation effectiveness, even if allowances are in PAWA of light and there is some loss with the optical deflection means 5, it is because it can be used satisfactory. In addition, of course, actuation is possible also considering light with smaller wavelength as a light of the 2nd wavelength.
[0050] (Gestalt of the 2nd operation) It explains focusing on a point which is different from the gestalt of implementation of the above 1st about the optical head of the gestalt of operation of the 2nd of this invention using drawing 4 .
[0051] The side elevation and drawing 4 (b) which show the basic configuration of an optical head and the situation of propagation of light are the rear-face Fig. showing the basic configuration of an optical head and the situation of propagation of light in the gestalt of operation of the 2nd of this invention. [in / in drawing 4 (a) / the gestalt of operation of this invention 2nd]
[0052] As shown in drawing 4 , in the optical head of the gestalt of this operation, the wavelength separation means 12 is formed in the front face of the transparence substrate 9, the optical deflection means 5 is formed in the opposed face, and the light 6 of the 1st and 2nd wavelength is a configuration which carries out incidence from the wavelength separation means 12 side. It becomes one accumulation component, and structure can be stable, and can become easy [alignment], and moreover the wavelength separation means 12 and the optical deflection means 5 which were united with the transparence substrate 9 also with the gestalt of this operation can be started, and can serve as a mirror.
[0053] to datum level 18, optical 6a of the 1st wavelength has been arranged at 45 degrees on parenchyma, for example, was prepared in the front face of the transparence substrate 9 which is glass with a thickness of about 1mm etc. -- for example It is reflected on parenchyma with the wavelength separation means 12 which is wavelength separation multilayers, 90 degrees of opticals axis are bent on parenchyma, and it is set to parallel light 10a of the direction of the z-axis, and incidence is carried out to an objective lens 4, and it is set to convergence light 7a, and is condensed on DVD11a which is an optical disk.
[0054] Optical 6b of the 2nd wavelength also penetrates the wavelength separation means 12 on parenchyma, and it passes along the inside of the transparence substrate 9. The straight-line-like blaze-ized grating of a reflex formed in the opposed face (-- for example, incidence is carried out to the optical deflection means 5 of the reflex which is 40-micrometer), only the direction component of a x axis is deflected and reflected, an optical axis becomes parallel to the parenchyma top z-axis, and, similarly a period carries out incidence to an objective lens 4, and is condensed by CD11b.
[0055] With the optical head of the gestalt of this operation, since optical 6a of the 1st wavelength is reflected on wavelength separation means 12 front face, without passing along the transparence substrate 9, efficiency for light utilization improves somewhat. However, since there is thickness of the transparence substrate 9 compared with the optical head of the 1st operation gestalt, the technical problem that the amount of gaps of the center position of the maximum reinforcement of optical 10a of the 1st wavelength and optical 10b of the 2nd wavelength which carries out incidence to an objective lens 4 becomes large occurs.
[0056] (Gestalt of the 3rd operation) It explains focusing on a point which is different from the gestalt of implementation of the above 1st about the optical head of the gestalt of operation of the 3rd of this invention using drawing 5 and drawing 6 .
[0057] The side elevation and drawing 6 which show the basic configuration of an optical head and the situation of propagation of light are the related Fig. of the incident angle theta 2 to a grating (optical deflection means), and primary diffraction efficiency in the optical head of the gestalt of operation of the 3rd of this invention. [in / in drawing 5 / the gestalt of operation of the 3rd of this invention]

[0058] it is shown in drawing 5 -- as -- the gestalt of this operation -- setting -- 1st light source 1a and 2nd light source 1b -- the parenchyma top datum level 18 -- receiving -- the height direction (the direction of the z-axis) -- for example, 400 micrometers was left and it arranges. Thereby, arrangement of the 1st and the 2nd light source becomes easy.
[0059] Moreover, for example, to a datum plane 18, 45 degrees optical deflection means 5a which is the straight-line-like grating of the reflex whose period is lambda= 40 micrometers was leaned in the direction perpendicular to the slot on the grating (x directions), for example, and is arranged. Thereby, a gap of the depth direction (the direction of a x axis) in the side elevation of the optical axis of optical 10a of the 1st wavelength which carries out incidence to an objective lens 4, and optical 10b of the 2nd wavelength can be lost on parenchyma.
[0060] As shown in drawing 6 , the primary diffraction efficiency of the reflex grating (the period of lambda= 40 micrometers, the channel depth of L= 0.267 micrometers, reflective film of Au) which is optical deflection means 5a of the optical head of the gestalt of this operation It was dependent on the angle of incidence theta 2, and when the angle of incidence theta 2 of optical 6b of the 2nd wavelength to grating 5a was range which fills -50 degree<=theta2 <=50 degree relation on parenchyma, it turned out that about 90% or more of high primary diffraction efficiency is realizable. With the gestalt of this operation, since the incident angle theta 2 was 45 degrees, 92% of diffraction efficiency was acquired.
[0061] (Gestalt of the 4th operation) It explains focusing on a point which is different from the gestalt of implementation of the above 1st about the optical head of the gestalt of operation of the 4th of this invention using drawing 7 .
[0062] The side elevation and drawing 7 (b) which show the basic configuration of an optical head and the situation of propagation of light are the rear-face Fig. showing the basic configuration of an optical head and the situation of propagation of light in the gestalt of operation of the 4th of this invention. [in / in drawing 7 (a) / the gestalt of operation of the 4th of this invention]
[0063] The optical head of the gestalt of this operation realizes the optical head of the super-thin configuration of for example, 9.5mm thickness.
[0064] As shown in drawing 7 , 3 beam grating, the focus / truck error signal sensing element 8, and the chromatic-aberration amendment grating 20 are arranged to the aperture side of the light source and the photodetector unit 17 at this order. Instead of the starting mirror, the prism 19 which has three optical surfaces is used.
[0065] the time of prism 19 setting the 1st page (slant face) 21 and light source 1 side to 22, and setting the 2nd page (side face) datum-level 18 side to 23 for the information record-medium 11 side the 3rd page (base) -- prism -- the 3rd page of the wavelength separation means 12 was formed in 23, and the optical deflection means 5 is formed in the inferior surface of tongue.
[0066] The outgoing radiation light 2 from the light source 1 penetrates 3 beam grating 24, and the focus / truck error signal sensing element 8, is the chromatic-aberration amendment grating 20, for example, is diffracted in about 1 degree and the direction of the z-axis, carries out incidence to a collimator lens 3, and turns into the abbreviation parallel light 6.
[0067] the light 6a and 6b of the 1st and 2nd wavelength -- prism 19 -- 22 [page / 2nd] is penetrated, total reflection of the 1st page is carried out by 21, and incidence of the 3rd page is carried out to the order of 14. It is reflected with the wavelength separation means 12, and optical 6a of the 1st wavelength penetrates 21 [page / 1st], and it carries out incidence to an objective lens 4. The wavelength separation means 12 is penetrated, it is the optical deflection means 5, and is deviated and reflected, an optical axis becomes parallel, and optical 6b of the 2nd wavelength penetrates 21 [page / 1st], and it carries out incidence to an objective lens 4.
[0068] Thus, the inside of prism 19 is made to spread in the shape of zigzag, by the configuration which bends 90 degrees of opticals axis, the height (the direction size of the z-axis) of an optical head is sharply made small, and a super-thin configuration is attained.
[0069] The specifications of prism 19 were thetar=5.0 degree, thetap=29.3 degree, and thetaq=114.3 degree, they set the die length of a base 23 to 4.4mm, and BK7 was used for them as ** material. In this case, if it is the configuration without beam plastic surgery made equal [the beam diameter which

carries out incidence to prism 19, and the beam diameter which carries out outgoing radiation], the refractive index of the ** material of prism 19 is set to n and an installation include angle at the bottom is set to thetar One side of the basic angle of the prism thetap of an include angle sin(thetap-thetar) =n-sin (4thetap-2thetar-90 degree-theta'), n-sintheta'=sin (thetap-thetar) shall be satisfied on parenchyma and include-angle thetaq of another side of a basic angle shall have the relation which fills +90 degree-2of theta q=theta thetar on parenchyma. Although considered as thetar=5 degree, when the installation include angle of prism 19 was within the limits of 2 to 8 degrees on parenchyma, allowances were enough born to spacing of the left end of an objective lens 4, and prism 19, and it turned out that it is desirable.

[0070] With the gestalt of this operation, since semiconductor laser is used for the light source 1, the phenomenon in which the main wavelength of outgoing radiation light changes with the breadth of an about 1nm wavelength band or change of environmental temperature typically arises by the high frequency module or self-oscillation.

[0071] With the gestalt of this operation, if breadth is in a wavelength band in order that an optical axis may carry out incidence aslant on the side face 22 and slant face 21 of prism 19, the chromatism that angle of refraction differs will arise. If change of the angle of diffraction of the diffracted light arranges the chromatic-aberration amendment grating 20 in an optical path so that it may be generated in the direction mutually set off against change of the angle of refraction in prism 19, it is possible for chromatism to be erased inside and to make it condense good on an optical disk 11.

[0072] this invention persons discovered that it was effective in it being better for the ** material of the glass which constitutes prism 19 to be low distribution, and being a broad wavelength field in such a case, and diffraction efficiency that manufacture of a component is easy and high being acquired since the period of the grating 20 which can offset chromatic aberration to extent which is not if it is a problem mostly, and amends chromatic aberration to coincidence is also large and it can do. Moreover, it was most actually, and that wavelength variation is within the limits of **10nm on the 1st wavelength could form the optical spot with little effect of chromatic aberration on the optical disk 11, when the Abbe number of ** material was 64 or more in that case, and it also turned out that it is effective. Therefore, as ** material, BK7, FC5, FK5, FCD1, FCD10, and FCD100 grade are desirable.

[0073] The optical head of the gestalt of this operation has arranged the grating of a homogeneity period as a chromatic-aberration amendment grating 20 in the convergence light optical path from the light source 1 to a collimator lens 3, or an emission light optical path. When this invention persons have arranged the grating 20 for chromatic-aberration amendment in such a convergence light optical path or an emission light optical path, Since what the amendment effectiveness changes with incident angles (the chromatic-aberration amendment effectiveness becomes large in the case where light inclined and carries out incidence) was understood, although periodic distribution of the grating 20 of the direction of the z-axis needed to be changed in accordance with the convergent angle of the outgoing radiation light 2, strictly When numerical aperture is arranged in 0.39 or less convergence light optical path or the emission light optical path, As for the spot on the optical disk 11 in an objective lens 4, it turned out that it does not become a problem by chromatic aberration, and it was possible to have used the grating 20 of a homogeneity period, and there were alignment and effectiveness that manufacture was easy.

[0074] As mentioned above, although the optical head of the gestalt of the 1st - the 4th operation of this invention has been described, it cannot be overemphasized that the optical head which combined the configuration of each optical head can also be constituted, and it has the same effectiveness in addition to the optical head of the gestalt of these operations.

[0075] In addition, although the optical disk explained the gestalt of operation, it is the range of this invention to apply to the product of the shape of the shape of the shape of a card designed so that the medium from which two or more specifications, such as thickness and recording density, differ with the same information record regenerative apparatus could be reproduced, or a drum, and a tape. Moreover, the objective lens and collimator lens which were used for explanation of the gestalt of operation are the same as the lens which names for convenience and is generally said.

[0076]

[Effect of the Invention] As explained above, according to this invention, it can respond to the information record medium of two or more classes, and small and the thin shape, and the lightweight optical head possessing two waves of light sources mutually arranged to near can be realized.

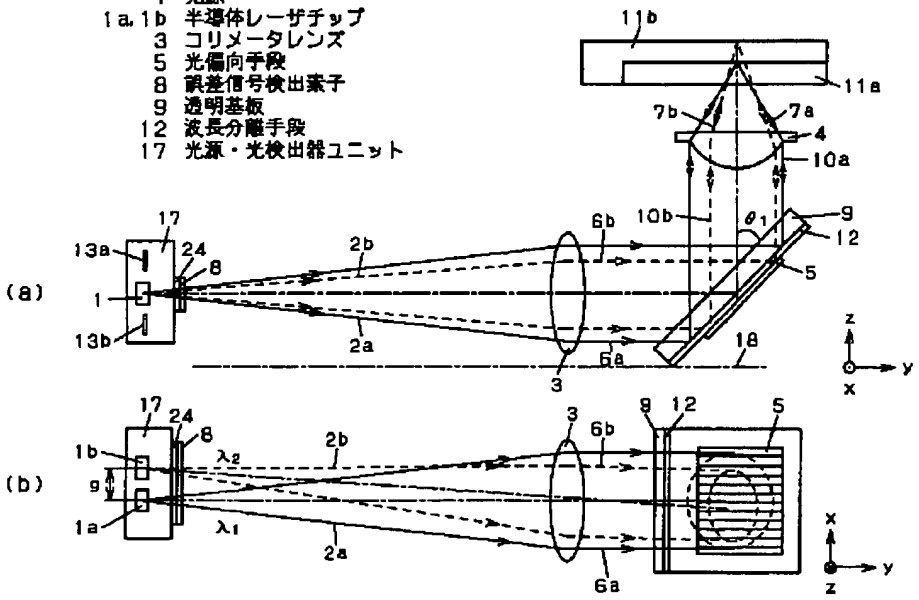
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

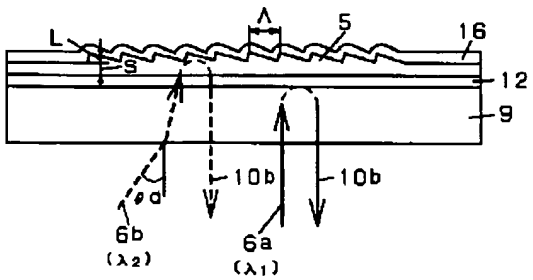
DRAWINGS

[Drawing 1]



[Drawing 2]

(a)



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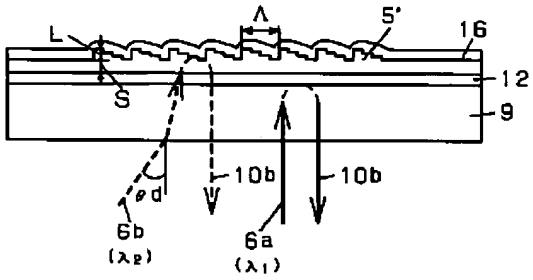
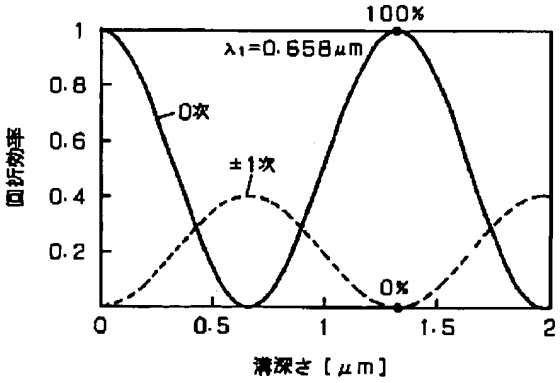


[Drawing 3]

(a)



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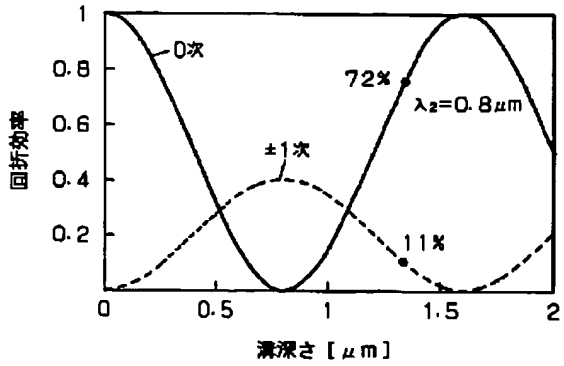
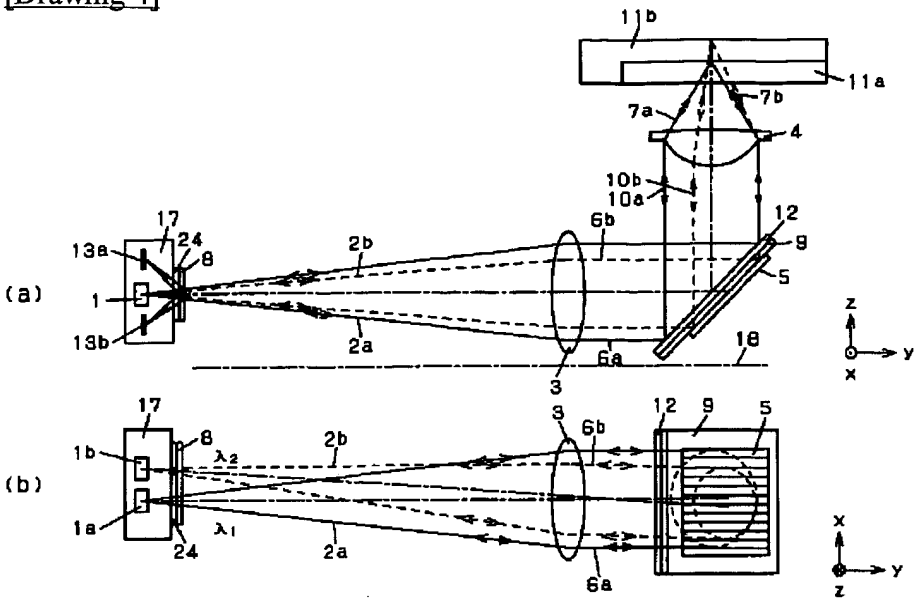
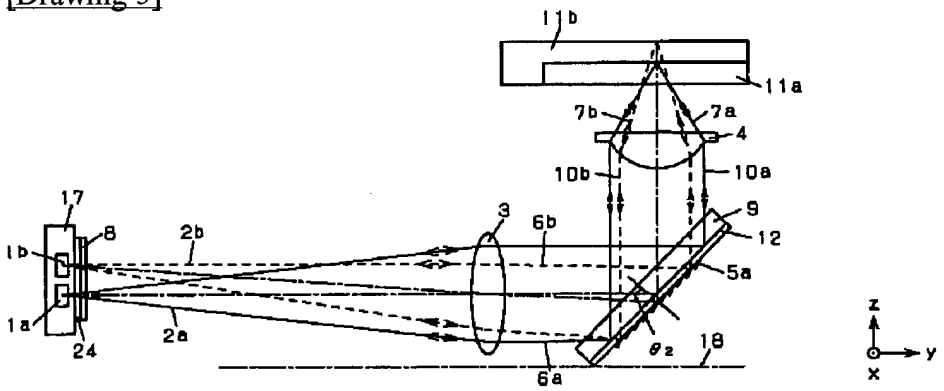


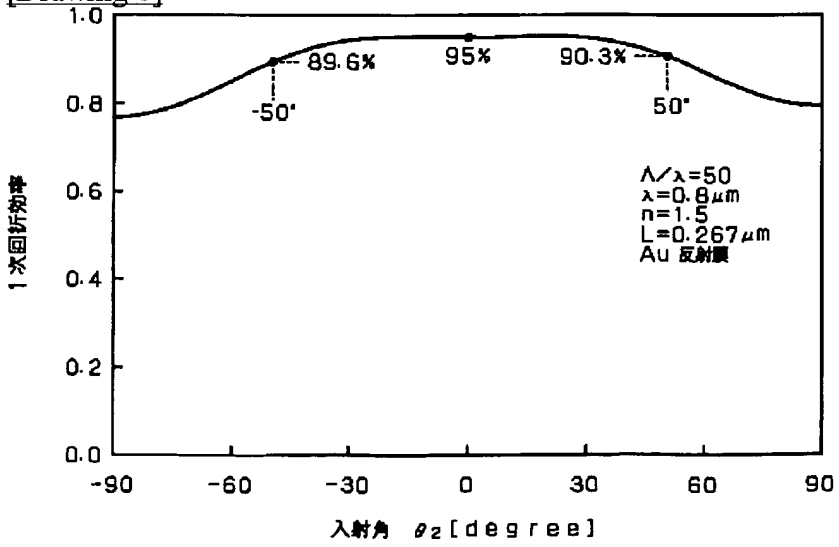
[Drawing 4]



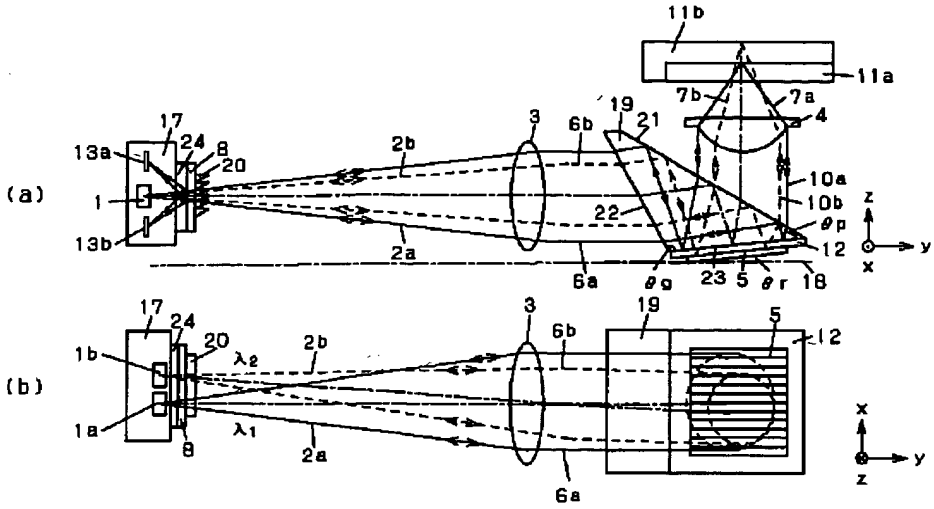
[Drawing 5]



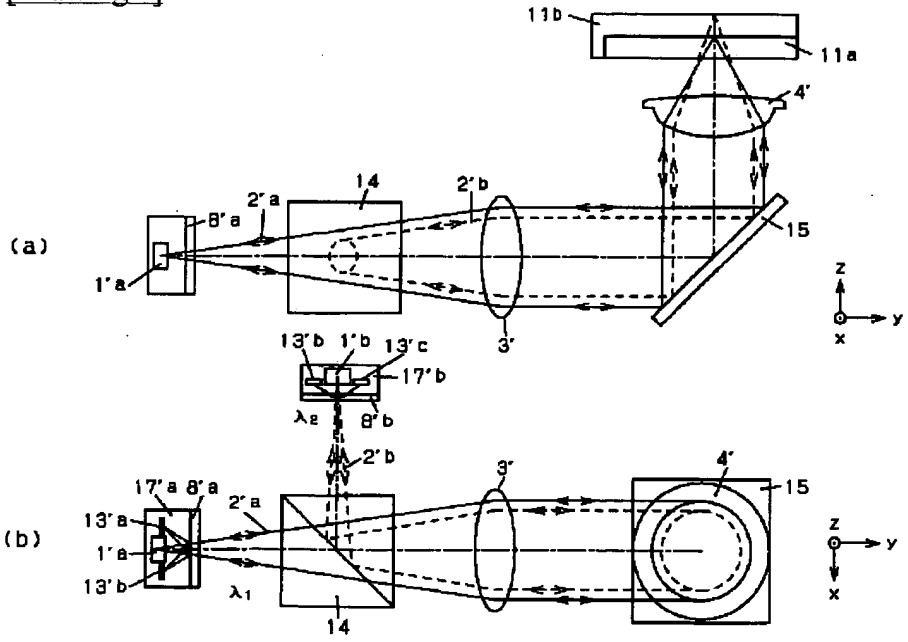
[Drawing 6]



[Drawing 7]



[Drawing 8]



[Translation done.]